

**Assessment of Plant Species for
Rehabilitation of Waste Land in Meja Tehsil**

THESIS

**Submitted for the award of the degree of
DOCTOR OF PHILOSOPHY**

**IN
BOTANY
BY
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SELF ATTESTATION

This is to certify that I have personally worked on the topic entitled as “Assessment of Plant Species for Rehabilitation of Waste land in Meja Tehsil” the data mentioned in the thesis are genuine. The research work done by me under the supervision of Dr. Eugenia P. Lal. The results of this work have not been submitted to any other University or Institute for award of any degree or Diploma.

PLACE: ALLAHABAD

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DATE:25/05/2018

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Sukh Lal

ASSESSMENT OF PLANT SPECIES FOR REHABILITATION OF WASTE LAND IN MEJA TEHSIL

ABSTRACT

Tree and forest were always considered as an integral part of Indian culture. This is amply supported by the ancient scriptures and historical records. Fertilizer and irrigation are important inputs to increase productivity of forest plantation. FYM in different proportion are generally used to increase the leaf area of plants due to the effect of available Nitrogen. This increases the photosynthetic surface and thus promotes growth. The experiments were conducted at village Bhasunder kala and Bagaha as two different sites I & II of Allahabad district in November 2011, to find out the effect of irrigation schedule and different organic manure on assessment of plant height, collar girth and survival percentage of seedling of *Pongamia pinnata*, *Emblia officinalis*, *Carrisa carandus*. The experiments consist of three

different age group of plants, given with different treatments of organic manure and different time interval of irrigation to study the seedling growth and the survival of plant.

Plantation was done on both sites Rocky and Usar. Twelve treatments and three different organic manure were applied with three irrigation regime (viz. 10 Days irrigation, 20 Days irrigation, 30 Days irrigation). Organic manure was given in quarterly dose in each treatment. All three replication with species *Pongamia pinnata*, *Emblia officinalis*, and *Carrisa carandus*, the best survival performance was given by species *P. pinnata*. In six month old seedling of *P. pinnata* best treatment T₁₀ (rocky-117.10cm and usar-108.34cm) with best rocky site. In one year old seedling treatment T₁₀ (rocky-170.60cm and usar-139.78cm) and two year old seedling treatment T₁₀ (rocky-193.67cm and usar-156.33cm). In view on age group two year old seedling gave a best growth increment overall treatment and age group with organic manure and irrigation regime.

Key words: Seedling growth, *Pongamia pinnata*, Collar-diameter, Rocky, Sandy loam, FYM, Neem cake, Vermicompost, Irrigation schedule.

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ABBREVIATIONS

%	:	Percent
/	:	Per
:	:	Ratio
M ha	:	Mega hectare
⁰ C	:	Degree centigrade
ANOVA	:	Analysis of variance
T	:	Temperature
CD (P=0.05)	:	Critical difference at 5% level of significance
S Ed.	:	Standard error deviation
cm.	:	Centimeter
F-test	:	Significant /Non significant
e.g.	:	For example
ESS	:	Error Sum of Square
et al.	:	And others
etc.	:	Etcetera
SS	:	Sum of square
F (Cal.)	:	Calculated value of 'f'
F (tab)	:	Tabulated value of 'f'
kJ/kg	:	Kilo Jule per kilogram
MSS	:	Mean Sum of Square
T ₀	:	Control treatment
NS	:	Non significant

r	:	Replication
RBD	:	Randomized block design
S	:	Significant
S Em \pm	:	Standard error
sp.	:	Species
Sq.m	:	Square meter
SS	:	Sum of square
T	:	Treatment
TSS	:	Total sum of square
fig.	:	Figure
g	:	Gram
i.e.	:	That is
Σ	:	Sigma
Kg	:	Kilogram
FYM	:	Farm Yard Manure
Max	:	Maximum
MESS	:	Error mean sum of square
Mg	:	Milligram
Min	:	Minimum
N.C.	:	Neem cake
Viz.	:	Namely

India is experiencing huge pressure on its natural resources with more than 200 million people being dependent on forests for livelihood. The rapid growth of the Indian economy puts additional demands on plantation for infrastructure and industrial development. With forest cover of 21 percent, India is one of the few developing countries that have historically suffered from heavy deforestation, that has now started of the increasing forest area and plans for an even further increase. However, the country is still holds vast areas of land classified as wasteland, meaning that it has a biomass productivity of less than 20 percent of its potential (**Ramachandra and Kumar 2003**). Overgrazing and abandoning of land together with inadequate rains drive land degradation and increase the wasteland areas. Wastelands are not necessarily unused, on the contrary grazing and marginal agriculture are often found there.

Rehabilitating of wastelands in Allahabad region with plantation activities is only possible, but in many cases desired by the local population and would lead to positive environmental, socio-economic effects at the local level. The reasons for the slow development of wastelands are a lack of financial resources, low land productivity and scarcity of water. A revaluation of the environmental of the trees together with a compensatory scheme for increasing carbon stock and vegetation cover could make an important contribution to the rehabilitation of wastelands.

The sodic soil is not good for farmers agriculture purpose due to high input of gypsum, chemical fertilizers and irrigation. (**Singh *et al.*, 1991**). The Forest Survey of India stated that country forest cover is 21.34 % of the topographical territory as per satellite measurements (ISFR, 2015). According to the Forest Survey of India, 2015, the forest and tree cover of UP is only 8.82% (forest cover 5.96% + tree cover 2.86%) of the total geographical territory.

Allahabad district has less than 2% forest cover of total geographical areas which is very less than required area of 33 %. Sodic (Usar), Silt clay, loam shows high pH (8.5-10), indicates very poor organic carbon and nutrient status. District Allahabad is found in south eastern part of state Uttar Pradesh. . It lies between those parallels of 24° 47' north and 81° 19' east Longitudes.

It's length from north and south is 109 km's and from east to west is 117 km's. The total geographical territory of the Allahabad is 5482 sq. kms and total wasteland 804.42 sq.kms. Barren and Mining area covers 348.52 Sq. Kms. & 1.5 Sq. Kms. Respectively **(As per census 2011)**. It is very difficult to establish new plantation in the area due to poor soil and water availability. Kali, Bhari red granules and alluvial soil in plane form are found in Meja Tehsil.

1.1. *Emblica officinalis* (Aonla)-

Aonla being a deep- rooted deciduous tree species has an extensive variety of flexibility to develop in any type of soil. It is viewed as a profoundly tolerant and potential organic product species reasonable for becoming under salt-affected and wasteland/ravine lands. Aonla gives higher monetary returns little interests in ranch foundation and its administration. **(Das et al., 2011)**. Amla is an ideal plant for arid and semiarid conditions. Aonla can be developed in minimal soils-somewhat acidic to saline/ sodic (pH 6.5-9.5) conditions. Irrigation at 15-20 days interval is desirable in dry summer especially early years of plantation foundation under waste land conditions. In the bearing estate, first irrigation should to be given just after compost and manure application (January/February). Irrigation should be avoided during blooming (mid-March-mid April) period. Irrigation at 10-15 days intervals should be given especially in the salt influenced soils. Aonla fruit is very rich in vitamin C and pectin. Harvesting of amla is in December-January month, sowing before monsoon. Aonla sets fruit in spring the fruits remain dormant throughout summer without any growth. This quality makes it highly suitable fruit crop for dry arid region.

1.2. *Pongamia pinnata* (Karanj)-

Pongamia are hardy plant, even then they require adequate moisture in the root zone during initial period. Irrigation once in a month during dry period will be quite beneficial for enhancing growth and productivity. Rainwater conservation techniques like planting on contour or staggered trenches will be advantageous in hilly, sloppy and rocky areas. *Pongamia* remains green during dry periods. *Pongamia* also thrives in arid areas to other fuel plant, it is for the most part found at bring down heights (0-500) in regions with normal temperature well over 20⁰C, however can develop at higher elevations and endures slight frost and develops well in conditions up to 1000 mm

rainfall (**Paramathma et al., 2004**). The species is discovered normally in littoral and riverian forest of India. It is considered as a multipurpose tree due to its different uses like fodder, shade, bio fuel, therapeutic uses and for nitrogen fixing in agroforestry. (**Vidha et al., 2011**).

1.3. *Carissa carandas* (Karonda)

C. carandas and *C. spinarum* are ease back developing species local to India. The stem is rich in white latex and the branches contain sharp spines. Blooms are little, measuring 3-5 cm in breadth, with white shading. The fruit type is a berry, which is formed in bunches of 3-10 fruits. Karondha is a little to enormous shrub as a rule 2-4m tall. Karonda is generally originated by grafting (**Singh, 2010**). However for karondha, huge rain and waterlogged conditions are harmful. Soil is not a limiting factor for its cultivation. It could grow in any soil except very alkaline or sodic soils. But for better production, fertile sandy loamy soil is better. After 6 to 8 months, plants attain transplantable height. (**Chandy, No.118**).

The southern uplands constitute part of Vindhyan range which is rugged, largely dissected and rise towards the south-east. The elevation in this region reaches up to 300 meters the sub-mountain region consist of the Bhabhar, a narrow bed of the alluvium and gravel which along its south fringes joins into Tarai area which previously consisted of long grasses and thick forests and was a marshy and damp tract. A definite portion of the Tarai region has been subjected to deforestation (**NAP, MOEF, 2007**).

1.4. Objectives:-

1. To study performance of suitable species for selected sites of Meja Tehsil.
2. To study physio-chemical nutrient status of soil before and after plantations.
3. Identification of site-specific technological treatments for aforestation programme.

1.5 Justification:

Various efforts were undertaken to the plantation of suitable tree species for these areas and by adding different doses of fertilizers and timely irrigation to the soils. So these studies were viable for that selected area and improve with organic matter, soil texture, water holding capacity, soil erosion fertility status and finally reclaim the Sodic and saline soil.



**Two year old seedling of Karondha
at the time of plantation (Rocky soil)**



**Two year old seedling of Karondha
at the time of plantation (Usar soil)**



**Six month old seedling of Karondha
at the time of plantation(Rocky soil)**



**Six month old seedling of Karondha
at the time of plantation(Usar soil)**

Plate-1



**One year old seedling of Karondha
at the time of plantation(Rocky soil)**



**One year old seedling of Karondha
at the time of plantation(Usar soil)**



**Two year old seedling of Karanj
at the time of plantation(Rocky soil)**



**Two year old seedling of Karanj after
two year of platation (Rocky soil)**

Plate-2



**Six month old seedling of Karanj
at the time of plantation(Rocky soil)**



**Six month old seedling of Karanj after
two year of platation (Rocky soil)**



**One year old seedling of Karanj
at the time of plantation(Rocky soil)**



**One year old seedling of Karanj after
two year of platation (Rocky soil)**

Plate-3



One year old seedling of Aonla at the time of plantation(Rocky soil



One year old seedling of Aonla after two year of plantation (Rocky soil)



Six month old seedling of Aonla at the time of plantation(Rocky soil)



Two year old seedling of Aonla at the time of plantation(Rocky soil)



Two year old seedling of Aonla after two year of plantation (Rocky soil)



Six month old seedling of Karondha at the time of plantation (Usar soil)



Six month old seedling of Karondha at the time of plantation (Usar soil)

Plate-5



One year old seedling of Karondha at the time of plantation (Usar soil)



One year old seedling of Karondha after two year of plantation (Usar soil)



One year old seedling of Karondha at the time of plantation (Usar soil)



Six month old seedling of Aonla at the time of plantation (Usar soil)

Plate-6



One year old seedling of Aonla at the time of plantation (Usar soil)



Two year old seedling of Aonla at the time of plantation (Usar soil)



Six month old seedling of Karanj at the time of plantation (Usar soil)



One year old seedling of Karanj at the time of plantation (Usar soil)

Plate-7



Two year old seedling of Karanj at the time of plantation (Usar soil)

Plate-8

Chapter-2

REVIEW AND LITERATURE

Mzoma, (1988) studied that *Eucalyptus camaldulensis* seedlings of 16-25, 26-35, 36-45 and 46-55cm height classes were used to examine the effect of planting stock quality on field performance. Survival, height and diameter (10cm above ground) were assessed 6 and 12 months after planting out. Significant height differences occur between the 16-25 and 46-55cm height classes at 6 months age. There were no significant differences in all these parameters at 12 months after planting out throughout the four height classes. It is concluded that the height classification for *E. camaldulensis* seedlings has very less value if the seedlings are in the 16-55cm height range. Until other nursery stock grading approaches are studied, 16-25cm seedling height class is as effective as the taller ones and would therefore be more economical for dry zone afforestation in Malawi.

Garg and Jain, (1996) analyzed that the Biomass Research Center at Banthra, Uttar Pradesh, to evaluate changes in sodic soil qualities coming about because of planting *Dalbergia sissoo* and *Terminalia arjuna*. The manor plots were built up in May-June 1981, by planting one year old seedlings in pits separated at 1.5 m (3900 trees/ha). Soil tests were taken from the planting time until 1989 from the inward part of plots. Litter examples were gathered for three year (1987-89). Root frameworks were uncovered of 3 solid and 3 powerless trees of every species. The outcomes demonstrated an adjustment in the different soil physical and chemical properties. Soil pH and ESP (interchangeable sodium rate) values diminished and soil natural carbon expanded, with changes more under *D. sissoo*. There was a reduction in mass thickness from 1.8 to 1.5 (10^3 kg/m^3) however an expansion in soil porosity from 40 to 48% and of water holding limit from 2.9 to 4.5 g/kg in the surface (15 cm) layer under *D. sissoo*. Yearly generation of litter was evaluated at 5.0 and 5.4 t/ha for *D. sissoo* and *T. arjuna*, individually. Leaf litter assumed an imperative part in the flow of supplements by these species and it is evaluated that higher measures of N (88 kg/ha) and K (25 kg/ha) would be returned by *D. sissoo*, and of Ca (64 kg/ha) and Mg (47 kg/ha) by *T. arjuna* return of P (6.7 kg/ha) was least by the leaf litter of the two species. The measure of supplements reused by leaf litter was in the request $\text{N} > \text{Ca} > \text{Mg} > \text{K} > \text{P}$. The investigation additionally showed that *D. sissoo*, being fit for creating more extensive root spread and

profound infiltration, enhances Sodic soils more productively than *T. arjuna* which has a poor sinewy and fine feeder root framework.

Peter et al., (1999) studied that the foundation, development and survival of *Eucalyptus regnans* F. Muell. seedlings at two locales more than three years under a scope of little gaps (up to 30m) and substantial holes (50m up to clear fells) in a hole cutting test in cash forest woods at Tanjil Bren, Victoria, Australia. In both the gathering of littler and bigger holes seedling thickness at Year three was fundamentally influenced by year of treatment, hole estimate, or potentially site. In the two gatherings, densities for the most part expanded with an expansion in whole estimate. Seedling height at three year of the prevailing/co-overwhelming seedlings fluctuated in the vicinity of 2m and 5 m, and was emphatically identified with whole estimate in the gathering of bigger holes (however not in the gathering of littler holes). In the bigger holes, seedling development was higher on consumed than on mechanically bothered seedbeds. In the vicinity of 20 and 70% of all seedlings made due from Year 1 to Year 3, and survival rates appeared to increment with expanding gaps estimate. The after effects of this examination show that a hole cutting framework is conceivably a reasonable silvicultural treatment in mountain slag woods as most hole sizes would have been considered satisfactorily supplied with *E.regnans* recovery three years in the wake of logging. In any case, recovery achievement is altogether influenced by year-to-year and site variety. Furthermore, the utilization of littler gaps sizes may bring about recovery disappointment in a few years and additionally at a few destinations.

Chamshama and Hall, (1984) reported over the first year in the field, survivals, heights and diameters across 2cm over the ground of *Eucalptus tereticornis* seedlings were inspected in connection to seedling height at the season of field planting. Seedling height evaluations of 10, 30, 50 and 60 cm were utilized and survival, height and diameter were surveyed. Survival rates were observed to be for the most part high, extending from 68.1% to 93.9% at one year of age, with the 60 cm height review exhibiting predominance. At one year of age, mean height for the 10 and 30 cm height grades were essentially not exactly those for the 50 and 60 cm height grades. There was less difference between height reviews in width achieved following a year however a pattern was evident of more quick breadth development with expanding starting plant height. It is inferred that utilization of taller planting stock is a straight forward approach to get most extreme conceivable early development in Eucalyptus stands. Be

that as it may, the training is fitting just where precipitation designs are adequately comprehended and a reliably sticky period for seedlings to wind up noticeably entrenched in the field can be predicated. In less unsurprising or less notable atmospheres, utilization of little, hardier, seedlings stays fitting.

Khan *et al.*, (2004) studied that, the survival and development of the nursery seedlings of Rudraksh (*Elaeocarpus ganitrus*) transplanted in the timber land stands having thick, scanty and open shelter. The transplants showed better development as far as shoot length, collar diameter, leaf number and leaf territory and survival in thick than in scanty and open shelter. The pathogen assault on seedlings was more in open shelter though bug catching networks were more in scanty covering. The harm by herbivore was more in open and thick shade when contrasted with inadequate overhang. In light of the present perceptions, it was proposed that ranch of Rudraksh should to be raised as understory under the built up timberlands / manors with little covering holes or in somewhat shaded territories for better achievement.

Murigoudra and Madiwalar, (2004) conducted that the field examination to contemplate the impact of planting strategies and manure levels on starting development addition of teak planted on the bunds of upland paddy field. Net addition in development traits of teak viz., plant tallness, collar diameter, number of primary stem hubs and leaf range per plant was not influenced because of planting techniques (pit strategies and crowbar gap strategy). While, net augmentation in all the development traits was altogether higher with utilization of 2.5 Kg FYM+ 30:15:30 NPK g for every plant. Supplement (NPK) content in leaves was higher with larger amount of compost application (2.5 kg FYM + 30:15:30 NPK g for each plant) showing more prominent take-up to supplement by the seedlings.

Silva *et al.*, (2004) assessed that dry spell protection component in a dry spell tolerant clone (CN₅) and a dry season delicate clone (ST₅₁) of *Eucalyptus globulus* Labill. in view of the reactions to dry spell of some physiological, biophysical and morphological attributes of compartment developed plants, with specific accentuation on root development and pressure driven properties. Water misfortune in abundance of that provided to the holders prompted a general lessening in development and critical decreases in leaf zone proportion, particular leaf region and leaf-to-root zone proportion. Root pressure driven conductance and leaf-particular pressure driven

conductance diminished as water stretch turned out to be more serious. Amid the examination, the dry season safe CN₅ clone kept up higher leaf water status (higher predawn and early afternoon leaf water possibilities), maintained a higher development rate (new leaf region extension and root development) and showed more noteworthy carbon distribution to the root framework and lower leaf-to-root range proportion than the dry season delicate ST₅₁ clone. Clone CN₅ had higher stomatal conductance at direct worry and additionally higher water powered conductance than Clone ST₅₁. Contrasts in the reaction to dry season in root biomass, combined with changes in pressure driven properties, represented the clonal contrasts in dry spell resistance, permitting clone CN₅ to adjust transpiration and water ingestion amid dry spell treatment and in this way drag out the time of dynamic carbon digestion.

David *et al.*, (2005) demonstrated that the three hard divider holder sorts, one styro piece compartment sort, and two work secured plugs were utilized to develop longleaf pine (*Pinus palustris*) seedlings at a nursery in Louisiana. In 2001, these compartment sorts, alongside exposed root seedlings (from an alternate seed source), were out planted on two old-field destinations and two cutover locales. There were critical site by treatment cooperation's. Second-year survival was higher on cutover destinations than on old-held locales. Root-neckline width of holder developed stock was decidedly identified with root development potential (RGP) and stature after two developing seasons. Holder developed stock with the most reduced RGP displayed the least general seedling survival. On three destinations, field execution of seedlings developed in work secured plugs was not as much as seedlings developed in different sorts of compartments. For styro square plate, treating cell dividers with copper expanded RGP yet did not influence field execution. Expanding the separating between compartment cells expanded distance across and tallness after two developing seasons. A root bound record (RBI) was produced and was figured for every compartment seedling by partitioning root-neckline distance across by the measurement of the holder cell. Survival was low when RBI was more prominent than 27%. Albeit extensive breadth exposed root stock can be beneficial to the extent survival and development is concerned, the same may not be valid for holders. Some 7-month old compartment seedlings may turn out to be too substantial for some holder sorts.

Singh and Bhati, (2005) assessed that the scarcity of good quality water in arid areas has resulted in a search for an alternative source of water for biomass production and

meeting the demand of fodder and wood. An experiment was conducted to see the growth of *Eucalyptus camaldulensis*, *Acacia nilotica* and *Dalbergia sissoo* using municipal effluent at Jodhpur, Rajasthan. Four treatments included T₁, municipal effluent at ½ PET (Potential evapo-transpiration); T₂, municipal effluent at 1 PET; T₃, municipal effluent at 2 PET; T₄, canal water at 1 PET. Application of municipal effluent produced best height and collar diameter in these seedlings. These variables were highest for *E. camaldulensis* than other two species. Percent increments in height and collar diameter were highest in 1998-99 in all these species except in *D. sissoo*, which indicated highest increment during 1999-00. However, the per cent growth increments decreased in later years, though it was relatively greater in T₄ than in other treatments. Mean annual increment (MAI) in height, collar diameter and biomass was highest in *E. camaldulensis* and lowest in *A. nilotica*. MAI in T₁ was at par to that in T₄, but it increased with increase in irrigation levels from ½ PET to 2 PET. Relatively greater biomass in T₁ than in T₄ at 24 and 36 months of age was due to nutrients applied through municipal effluent. But at 48 months of age, lesser biomass in T₁ than in T₄ showed that municipal effluent application at 1/2 PET was not sufficient for the seedlings at 48 months onwards. The results suggest that recycling of municipal effluents through tree plantations can be an environmentally sustainable and reliable means for producing fuel wood, while restoring degraded land of dry areas.

Alejandro *et al.*, (2006) studied that in degraded Mediterranean woodlands, nutrients, in addition to water, may be the major factors controlling reforestation success. But information on nutritional status of planted seedlings is low. We aimed to evaluate the nutritional status and field performance of *Pinus halepensis* and *Quercus ilex* seedlings planted on two characteristic Mediterranean forest soils developed from marl and limestone. We used root growth response to localized N and P enrichment, and foliar analysis as indicators of nutrient limitation. Vermiculite cores enriched with P showed higher root density than N-enriched and control cores, particularly on soils derived from marl. Three years after planting, seedlings showed low foliar P and K as compared to other species and adult trees. Principal Component Analysis conducted on foliar macronutrient concentration clearly separated species and soil type. Foliar K and Mg depended on soil type (higher on limestone and marl, respectively), whereas N, P and Ca concentration in leaves and needles differed between species (higher N and P in pine, higher Ca in oak). Survival and growth depended on species and site, but we

found no effect of soil type on these variables, suggesting that seedling performance may not be strongly affected by nutrient status within the range of soils evaluated.

Shivanna *et al.*, (2007) conducted experiment during 2005-06 at Department of Agroforestry, College of Forestry, Sirsi. The seeds of *Pongamia piñata* were collected from eight different locations falling under tropical climates. Initially, seeds were measured for seed length, width and 100 seed weight. The seeds were sown in poly bags in a randomized block design. Daily germination was recorded and seed sources were assessed for germination per cent and observations were also recorded on growth parameters like seedling height, collar diameter, number of nodes and number of leaves per seedling. There was significant difference among seed sources for seed and seedling traits. The mean values for seedling height, collar diameter, number of nodes and number of leaves for eight sources were presented in the paper, indicated significant differences between seed sources for all these growth parameters studied. S₂ and S₆ attained maximum and minimum values respectively for seedling height, number of nodes and number of leaves. Collar diameter was found maximum and minimum for S₁ and S₆, respectively. However, an overall consideration revealed that S₁ and S₂ seed sources were found superior to rest of the seed sources with respect to seedling growth' parameters.

Bayala *et al.*, (2009) studied that the five exotic tree species *Acacia angustissima*, *A. mangium*, *Gliricidia sepium*, *Alp. Leucaena* & *Leucaena leucocephala* were research to decide if parameters of nursery seedling stock quality could be utilized to anticipate their field execution in an estate flooded with treated waste-water to deliver grain and wood. Plants were developed in the nursery in two differentiating establishing substrates (standard nursery soil and sand). The results showed that root collar diameter and DQI appeared to be the most appropriate indicators to predict the out planting performance of the five tested species in a short-rotation irrigated plantation in semi-arid Burkina Faso. The former measure is simpler and non-destructive.

Chris *et al.*, (2009) considered that survival percentage and mean percentage change in height were looked at for 19 native tree and shrub species planted at Ankafode Forest, a debased section of highland forest, at ten months agter planting. The best species in both, survival and development are *Macaranga alnifolia* , *Harungana madagascariensis*, *Filicium decipiens* & *Dodonaea madagascariensis* . An examination

of survival between short seedling and tall seedlings was revealed no significant difference.

Ruiz-Valdiviezo *et al.*, (2009) studied that the impacts of various inorganic fertilizers and rhizobial inoculation on shoot height, total shoot and root dry weight, knob number, total shoot nitrogen, nitrogenase function and tannic acid substance of *Acaciella angustissima* Britton and Rose were examined in the research center. The combined testing of N, P or K to uninoculated plants increase shoots height and dry weight when compared to the unamended plantlets. The tannin content in uninoculated plants was highest when changed with P+K. Treatment significantly affected plant development, nodulation and tannin content changed. The plants treated with P + K + *S. mexicanum* had significantly longer shoot height, total shoot and root dry weight, knob number, total shoot nitrogen, nitrogenase function and tannic acid substance in examination with unamended plants. It was discovered that N decreased number of knobs, tannin acid substance and nitrogenase function of *A. angustissima*. All things considered, farmers should avoid applying N fertilizers, yet could apply P and K to maximize tannin production in *A. angustissima*.

Bhadauria *et al.*, (2010) worked on alkali wasteland (3 hectares) of village Ishwarpur of Mainpuri region in Uttar Pradesh was chosen for sustainable land use planning at small scale level. Keeping in see the pre-existing land use, soil properties, cultivating group's needs and problems based on socio-economic survey, land capability, irrigation modes and literacy was only 2.5% soil moisture, 1.6% WHC, 3% Field capacity, 10% bulk density, 3% total porosity and 2% non capillary porosity, yet after biotechnological interventions, these parameters changed to 6.0, 5.2, 8, 16.4 and 10 %, respectively. 60% alkali wasteland was recovered by traditional method and showing in 3 hectares was set up by *Emblica* cultivation through biofertilizers in such soil. The farmers utilized these biotechnological interventions for developing many plants, tubers, beats vegetables and so on. The biotechnological management practices incorporate utilization of bioinoculants, Vermicompost, debased compost of biomass (Molasses, *Eichhornia*), Organic development supplements and biopesticides for productive farming. The farmers utilized their territory till maximum for serious development.

Kumar and Reddy, (2010) studied that, the metropolitan sewage both untreated and treated, that contaminates the water bodies was utilized developing Casuarinas

(*Casuarina equisetifolia*) a fascinating bioshield tree species on sandy soil at Kalpakkam on the East Coast of Indian peninsula; it might help in reducing aquatic contamination and in keeping prevention the high tides like Tsunami. The significant result was shown in sapling irrigated with untreated metropolitan sewage in plant-height, branches, root length and the biomass and treated sewage compared to that irrigated with unpolluted potable water over a period of 13 months, October 2005 to October 2006.

Emrah et al., (2010) examined that early field development of *Fraxinus angustifolia* and *Ulmus laevis* rooted cuttings was compared and that of seedlings utilizing yearly measurements collected during three years at a base land site in Adapazary, Turkey. After three year the result comes of field development, over 99% of the plants had survived. Height and diameter increments of the rooted cutting of tight leaved ash toward the finish of third year were higher than that of seedlings. The height of rooted cuttings and seedlings found the averaged value of 232 and 208 cm, respectively. Be that as it may, height and diameter increments of white elm seedlings were higher than that of rooted cuttings. After three year of field development, the height of rooted cuttings and seedlings of white elm arrived at the average of 221 and 269 cm, respectively. Stock size and the connection between stock type and stock size had no impact on three years development factors in the two species. Stock type and stock size had no effect on three years growth variables in both species.

Tomar et al., (2010) examined that *Phyllanthus amarus* is a critical restorative plant ordinarily known as Bhumyamalaki. In the nursery raised seedlings of *P. amarus* nitrogen and phosphorus medicines were connected as: T₀ Control, T₁, 30 kg N/ha, T₂, 40 kg N/ha, T₃, 50 kg N/ha, T₄, 30 kg N +50 kg P/ha, T₅, 40kgN +50kgP/ha, T₆, 50kgN +50kgP/ha. The best outcomes were recorded in T₄ (N30*P50) medicines when contrasted with others. The plants treated with N30 and P50 had most elevated plant tallness, number of branches, neckline measurement, crisp and dry weight of shoot and most elevated biomass.

Chavan et al., (2011) examined that in *Casuarina* species, character association and path coefficient analysis were worked out for 11 factors utilizing five species in Northern dry zone of Karnataka. Genotypic correlations were higher than phenotypic correlations for all the factors. Greater significant positive correlations of biomass with

tree height clear bole height, diameter, number of branches, crown spread, and volume of wood and volume index saw at both genotypic and phenotypic level. Path coefficient investigation of various attributes contributing towards production of biomass yield per tree uncovered that volume of wood had practiced highest direct positive effect. In comparative pattern coordinate constructive outcome from number of branches followed by clear bole height and diameter for biomass generation was at low magnitude. however, volume index applied negative direct impact on biomass yield per tree followed by bark thickness, needle length and crown spreading. Most extreme positive circuitous impact on biomass was applied by clear bole stature through volume of wood.

Doharey *et al.*, (2011) carried out an investigation was led to screen appropriate 'aonla' cultivars for agri-horti framework quantify low cost moisture conservation practice as weed mulch for aonla developed on waste land of Doon Valley at Indo-Italian Fruit Development Project at Dhakrani, Dehradun. The four cultivars of aonla with three levels of weed mulch in urd-toria crop rotation were tested on degraded lands of Doon Valley. NA-7 cultivar of aonla was recorded greatest natural product yield (59.8 kg tree⁻¹), grain yield of Urd (6.1 qha⁻¹), Toria (4.5 qha⁻¹) and covering volume (78.5 m³) on such land took after by Chakaiya which accomplished - 1 canopy volume (90.2 m³), organic product yield (58.1 kg tree⁻¹) with least grain yield of 'urd' (5.76 qha⁻¹) and 'toria' (4.54 qha⁻¹). NA-7 watched most extreme organic product estimate (43.76 g) trailed by NA-10 though Chakaiya delivered greatest vitamin-C (561.73 mg 100 g natural product⁻¹) and TSS (21.62 %). Weed mulch applied @ 20 kg tree had saved more dampness and impacted development and yield qualities in every one of the cultivars when contrasted with control plot fundamentally. Monetarily, NA-7 is better to intercropping with urd-toria edit pivot when contrasted with Chakaiya, NA-10 and NA-6. Subsequently, it is presumed that NA-7 cultivar of aonla is most suited for agri-horti framework on debased grounds because of less canopy volume and good return from the system.

Luna *et al.*, (2011) studied, a test in July, 2005 at Kharkan Research Station, Hoshiarpur to discover the impact of water irrigation regimes viz., no water irrigation (I₀), water irrigation following 10 days (I₁₀), water irrigation following 20 days (I₂₀) and water irrigation following 30 days (I₃₀), and fertilizer (Urea) doses viz., no fertilizer (F₀), 50 g/tree in July (F₁), 25 g two times during July and August (F₂), 16 g three times

during July, August and September (F₃), 100 g in July (F₄), 50 g two times during July and August (F₅), 33.3 g three times during July, August and September (F₆), 150 g in July (F₇), 75 g two times during July and August (F₈) and 50 g urea/tree, three times during July, August and September (F₉). Fertilizer dose in the 8,9 second and third year was expanded by 50% to the quantity applied during previous year. In first year water irrigation regimes had had no significant effect on collar diameter and height of teak, in any case, fertilizer dose of 33.3 g Urea / tree, three times in July, August and September, gave maximum collar diameter (2.43 cm). The interaction, 33.3 g Urea / tree and no water irrigation gave higher collar diameter (2.89 cm) and tree height (1.13 m), up to the age one year. Ultimately results that water irrigation administration I₁₀ for first and second year and I₂₀ during third year were better for development of teak trees. The fertilizer dose 33.3 g applied three times, during July, August and September, every year resulted.

Rana et al., (2011) examined that, the techniques of nursery, development and dry progression of Multipurpose Tree Species (MPTS) areas, soil position and cash crop of agroforestry system in sodic waste land. In nursery, development reactions of one-year old seedlings of *Dalbergia sissoo* and, *Acacia nilotica* seedlings shows that the development and dry weight diminished as the level of sodicity and saltiness increase in the two species. The reaction occurs in two species were similarly higher under sodicity levels than under saltiness levels. Among MPT's areas, the stand biomass for various species from 81 to 171 t/ha (*Populus deltoides* versus *Casuarina equisetifolia*). Add up to yearly litter fall in various farmers went from 217 to 609 gm⁻² yr⁻¹. Under various agri-silviculture systems the grain yields of wheat and paddy were lower than that of open field condition. If there should be an occurrence of 9-12 year old agroforestry system, add up to carbon biomass (above and subterranean segments of trees and yields) went from 46.1t/ha (*P. deltoides* based agri-silvicultural framework) to 51.9t/ha (*C. equisetifolia* based agri-silvicultural framework). Carbon stockpiling under *C. equisetifolia*-*Psidium guajava* based agri-silvi-agricultural framework was 54.2 t /ha, which was most outstanding among all agroforestry system. Among grasses, *Pennisetum purpureum* indicated most extreme herbage yield under *Dalbergia sissoo* based silvi-peaceful system. On the two stands, the generation was most extreme during stormy season and least during summer. In *C. equisetifolia* based agri-silvi-plant framework the crisp rhizome yield for turmeric was 8.6 t ha⁻¹, which was more note

than the yield (7.6 t/ha) got in open zone. There was a general change in soil physico-substance properties under agro-forestry system.

Bagali *et al.*, (2012) studied that, the field trials were led for two seasons of summer 2004-05 and 2005-06 at Regional Agricultural Research Station Bijapur (Karnataka), on medium deep black soil to study the effect of scheduling of drip irrigation on the growth, yield and water use efficiency of onion (cv. Telagi Red). The treatment included three period (prime medicines) and three levels of water irrigation with flood irrigation as control. The outcomes demonstrated that shorter interval of water irrigation M_1 (one day interval) recorded altogether higher bulb yield (46.93 t/ha). The yield increment in M_1 was mainly due to significantly higher performance of growth and yield parameters. The 100% PE (S_3) recorded altogether higher bulb yield (50.92 t/ha) contrasted with 80 and 60 % PE flood irrigation and this reflected in development and yield parameters moreover. Significantly higher bulb yield was recorded in one day interval of water irrigation at 100% PE (54.91 t/ha) which was comparable to two days interval of water irrigation at 100% PE (52.83 t/ha). Significantly higher number of leaves, leaf range, LAI and neck girth per plant, and equatorial diameter, polar diameter and bulb weight were recorded in M_1S_3 , M_2S_3 contrasted flood irrigation. Both one day (M_1) and two days (M_2) interval of water system and 60% PE (S_1) recorded significantly higher WUE, while the cooperation impacts were non—significant. The interval and levels of water irrigation and their blends were significantly superior for WUE, contrasted with flood irrigation.

Singh and Hymavathi, (2012) studied that, the field trial on Agri-Silviculture agroforestry system with three plant geometries and two intercrop spacing (60 cm and 120 cm) tree to crop line was held in the on-station at Tropical Forest Research Institute, Jabalpur (M.P.) during 2008-2009. The greatest increment in height (22.56 cm) and collar diameter (0.628 cm) was seen in spacing $6m \times 6m$ and 60cm crop line spacing with respect to initial height and collar diameter.. The tree separation of $5m \times 5m$ with 60cm crop line spacing delivered greatest yield of maize in *Dalbergia sissoo* - *Zea mays* (Agri-Silvi) agroforestry system. This *Dalbergia sissoo* - *Zea mays* (Agri-Silvi) agroforestry system can be suggested for enhancing the soil fertility and conserving soil moisture content accordingly improving the soil productivity along with development of tree species.

Singh and Sharma, (2012) studied, the litter fall included by trees advances the organic matter and supplement substance of soil under the trees. The impact of tree species was assessed on soil organic carbon (OC), available macro (N, P and K) and micronutrient (Zn, Fe, Mn and Cu) concentration of soil and their accumulation in the soil under 8 year old *Eucalyptus tereticornis*, *Azadirachta indica*, *Melia azedarach*, *Dalbergia sissoo*, *Albizia lebbbeck*, *Leucoena leucocephala*, *Acacia nilotica* & *Tamarix articulata* separated at 6m × 3 m and in open (control) in arid zone area of Punjab at Regional Research Station of Punjab Agricultural University (PAU) at Bathinda. Siris and eucalyptus accomplished a more diameters at breast height and height than other tree species. The accumulation of soil OC and accessible supplements were higher under trees than control. The soil OC and supplement decrease with increment in depth soil OC increase by 50.3% under siris took after by shisham (43.4%) and kikar (40.6%) over control (3.62 g/kg) in the surface soil layer. The OC sequestration in the 0-120 cm soil depth changed from 37.1 Mg/ha under eucalyptus to 42.2 Mg/ha under shisham. The accessible N was higher under subabul, shisham, kikar and siris than the other tree species in the surface and in addition in 0-120 cm soil depth. Accessible P and K were higher under kikar and subabul than other tree species. All the micronutrients were higher under the tree species as compared to control. Thus, the tree plantations can contain the soil good by improving the different soil properties.

Rahman et al., (2012). Determined the effect of weed management on growth, fruit production and changes in soil physico-chemical parameters in a *citrus* orchard. Studies compared of two orchard floor management practices i.e. cultivation and mowing. In Cultivation, the result indicated that all the growth parameters responded significantly to management practices. Similarly, soil physico-chemical parameters were also affected. Shoot growth, canopy diameter, Trunk Cross-sectional Area (TCSA) and fruit yield were increased. Soil bulk density was decreased and consequently soil porosity was increased. In Mowing the results indicated superiority of mowing practice over conventional cultivation towards plant growth, yield and improvement in soil physical properties.

Mohammad et al., (2013) examined to discover the parameters for determination of predominant trees of *Pterocarpus marsupium*. The examinations related with connection and way analysis, showed clear bole height, girth at breast height and total plant height were the most critical parameters which could be considered for

choice of unrivaled plants of this species. Actually, it would be suitable if these parameters are consolidated in creating methodology for choice and hereditary change of the species.

Revath *et al.*, (2013) examined that the biofertilizers & bio manures are highly useful for afforestation and reclamation of degraded lands, mined over weights and other problematic areas. Integrated Nutrient Management (INM) is a recently developed practice in agriculture where sustained high bio mass production has become a vital necessity of the country. The result was made to determine the effect of inorganic fertilizers i.e., macro nutrients (N, P and K) and micro nutrients (Fe, Zn, B and Mo) with biofertilizers such as N fixing bacteria (Rhizobium) and P mobilizing symbiotic fungi (AM fungi) and bio manures (leaf manures) in normal and alkaline soils on seedling growth of *Dalbergia sissoo*. It was observed that dual inoculation with biofertilizers (Rhizobium and AM) was impressive in improving the growth and biomass of Shisham under normal soil whereas in alkaline soil, blending of micronutrients with biofertilizers (Rhizobium + AM) had better growth and biomass.

Singh and Bhati, (2013) an examination was led to see the development of *Eucalyptus camaldulensis*, *Acacia nilotica* and *Dalbergia sissoo* utilizing metropolitan effluent at Jodhpur, Rajasthan. Four treatments T₁ , municipal effluent at ½ PET (Potential evapotranspiration); T₂ , municipal effluent at 1 PET; T₃, municipal effluent at 2 PET; T₄, canal water at 1 PET. Using of city municipal effluent got better height and collar diameter in these seedlings. These factors were highest for *E. camaldulensis* than other two species. Percent assessment in height and collar diameter was greater in 1998-99 in all these species except in *D. sissoo*, which demonstrated highest increment during 1999-00. Although, the percent growth development decrease in later years, while it was moderately greater in T₄ than in other treatment. Mean annual increment (MAI) in height, collar diameter and biomass was highest in *E. camaldulensis* and most reduced in *A. nilotica*. MAI in T₁ was at par to that in T₄; however it increase with increment in water irrigation levels from ½ PET to 2 PET. Generally more biomass in T₁ than in T₄ at 24 and 36 months of age was due to supplements nutrients applied. In any case, at forty eight month of age, lesser biomass in T₁ than in T₄ demonstrated that metropolitan effluent application at 1/2 PET was not adequate for the seedlings at 48 months onwards. The result recommend that reusing of municipal effluents through tree

plantations can be an ecologically sustainable and reliable means for producing fuel wood, while reestablishing degraded land of dry areas.

Jai Shankar *et al.*, (2014) an experiment carried out in 2012–14 in *Dalbergia sissoo* at TNPL, Karur, Tamil Nadu, India. The experiment was conducted in randomized block design with four replications. There were six different treatment combinations of soil test value based organic and inorganic fertilizers. Among the treatments, 125 % of STV 138:98:65 NPK kg/ ha+ VAM (100g/ plant) + Azospirillum (50g /plant) + Phospho bacteria (50g/ plant) + FYM (500g/ plant) recorded significantly maximum growth parameters and nutrient uptake followed by 100% of STV - 110:78:52 NPK kg/ ha + VAM (100g/ plant) + Azospirillum (50g/ plant) + Phosphobacteria (50g/ plant) + FYM (500g/ plant). The results showed that soil experiment value based integrated application of organics along with inorganic fertilizers could increase the growth as well as dry matter production in clonal plants of *Dalbergia sissoo*.

Kumar and Wani, (2014) studied that an examination was done to production of *Dendrocalamus strictus* under nursery conditions at three level of integrated nutrient management (INM) combinations viz. N, P₂O₅ and K₂O (2.0, 1.25, 1.25; 1.5, 0.938, 0.938; 1.0, 0.625, 0.625 g / kg of soil) connected as urea, single super phosphate and muriate of potash alongside FYM 500g and biofertilizers viz. VAM and *Azospirillum* each @ 40, 20g / kg of soil separately were compare with unfertilized soil (control). The result indicate that combination of 1.5g N, 0.938g P₂O₅ and 0.938g K₂O per kg of soil supplemented with FYM (500g), VAM (40g) and *Azospirillum* (20g) fundamentally upgraded the development parameters viz shoot length, number of leaves, root length, collar diameter , dry matter, volume index and quality index of *D.strictus* seedlings over control treatment of soil.

Chapter-3

MATERIALS AND METHODS

This chapter deals with materials used and the methods adopted to carry out the experiments in the present investigation entitled “**Assessment of Plant Species for Rehabilitation of wasteland in Meja Tehsil**”

3.1. Study Area

The study was carried out in the two selected sites of southern zone of UP covering district Allahabad in southern eastern part of UP.

1. Bhasunder Kala- Meja (Rocky-Sandy loam soil)

2. Mejaroad (Barren- Usar land)

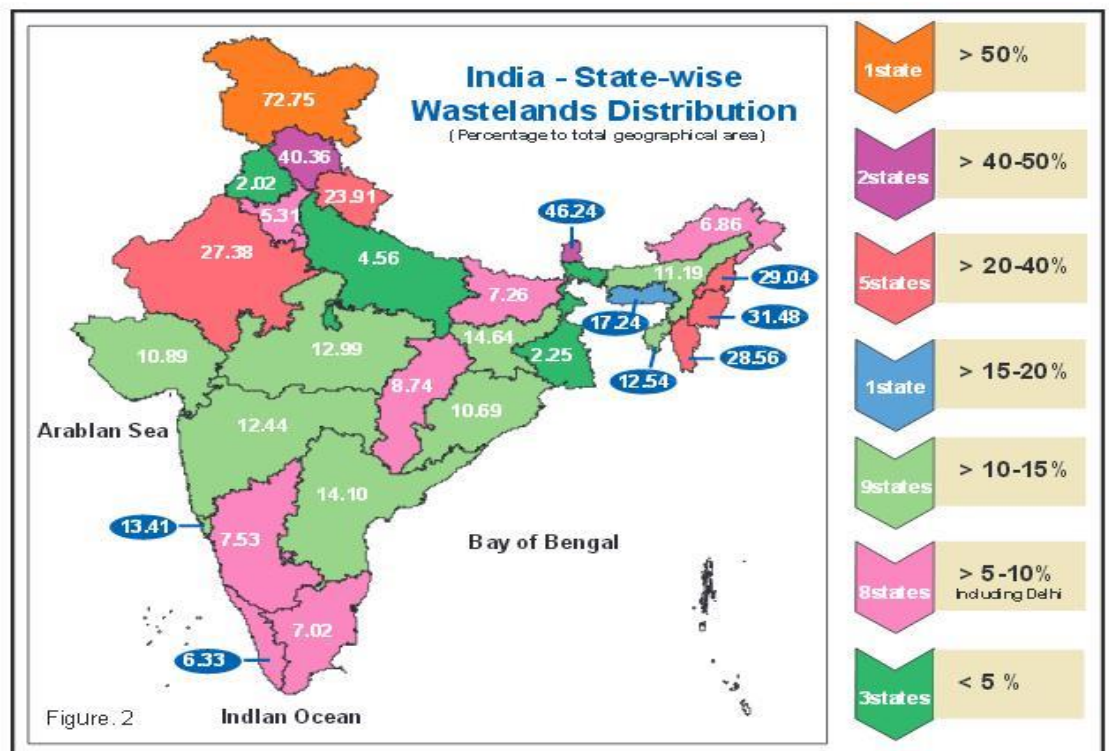
3.1.1. Bhasunder Kala Meja - (Rocky land):

The study area village Bhasunder Kala (Meja) lies between the latitude 25.1569⁰ and longitude 82.07695⁰ under district Allahabad (Tehsil Meja) in the southern- eastern part of the Uttar Pradesh state. That recorded forest region of the state is 5.17 ha which constitutes 17.55% for its geological region. (**Kumar *et. al.*, 2000**).

3.1.2. Mejaroad (Barren- Usar land):

In Uroowa block Meja road the field under forest had been nil. It Might be expanded will around 1.0 percent of the some part of fertile waste land could be used for social forestry. Barren land could be reduced and a part of it could be utilized to meet increasing need of land for non-agricultural purpose. The area under fertile waste land had increased by around 1.0 per cent of TRA after 1985-86. The proportion of fertile waste land increased from 0.95 per cent in 1985-86 to 1.8 percent in 2000-01.

According to viewing report 2000-01 of all twenty blocks of Allahabad district has higher percentage of barren / uncultivable land of meja tehsil is 8.76% of TRA (94804 ha.) (**Kumar *et al.*, 2000**). Due to this reason Meja Tehsil is selected for plantation purpose.



Source: Wasteland map of India (2011), Dept. of land resources, Govt. of India.

Fig: 1 India- State- wise wastelands distribution.



Source: Matilda Plam (2011) Rehabilitating Indian wasteland a role for afforestation. Focali Brief.

Fig.2 Village Basunder kala type soil (Rocky soil).

3.2. Topography, Climate and Weather:

Topographically, the district of Allahabad belongs to the central plane zone of Uttar Pradesh.

The southern part of Allahabad district also known as yamunapar is partly rocky and somewhat agriculturally backward. Out of total cultivated land 64% of the area is irrigated (Canal, Tube Well Govt. & Public) and 36% is rain fed.

Table-1: Types of soil found in Allahabad district:

AES	Situation	Soil type	Area in % / x000 ha.	Block
2.AES1	Black & coarse gray land (Jamunapar)	Clay loam to sandy loam	48% / 230.1	Shankargarh, Koraon, Manda, Meja
3.AES2	Jamuna Khaddar & alluvial ((Jamunapar)	Loam & Sandy Loam	10% / 51.1	Jasra, Karchhana Chaka, Kaundhiara
4a.AES3	Ganag low land & sodic (Gangapar)	Sandy loam to Sodic	15% / 92	Pratappur, Handia, Phulpur
4b.AES3	Ganga plane (Gangapar)	Sandy loam & Clay	27% / 138.1	Phulpur, Saidabad, Soraon

(Source: Government of U.P. District profile Allahabad 2001.)

Table: 2. The rain fall and temperature with relative humidity:

Months	Rain Fall(mm)	Temperature (°C)		Relative Humidity (%Average)	
		Max.	Min.	Max.	Min.
Oct.2008	72.4	36	18	98	43
Nov.2008	1	33.4	9	96	36
Dec.2008	0	27.6	5.8	100	35
Jan.2009	0	28.4	5.8	100	27
Feb.2009	0	32.4	11	92	26
Mar.2009	0.2	37	14.8	77	16
Apr.2009	2.8	44.2	19.8	72	14
May.2009	55.4	44.8	23	82	14
June.2009	3.5	45.2	23.2	81	16
July.2009	149.4	38	24.4	92	27
Aug.2009	102.2	37.6	25.2	100	34
Sep.2009	114.2	34.6	26	95	60

(Source: Government of U.P. district profile Allahabad, 2001.)

It has tropical climate and the average higher temperature range between 43⁰C – 45⁰C which may go as high as 46⁰C during peak summers. (As per India map) The lower temperature is 8⁰C – 9⁰C which may fall up to 4⁰C (December – January). The average rainfall of the region is 960 mm. and the rainstorm season will be spread between of July-September.

3.3. Collection of Seedling and organic manure:

The common species was selected on ecological and sociological basis for the experimental trials. On the basis of literature and farmer's interview, following species was taken up under the works:

1. *Carissa carandas* (Karondha)
2. *Pongamia pinnata* (Karanj)
3. *Emblica officinalis* (Aonla)

Trial species was collected from State Forest Department Nursery, Naini, Pandey poadhshala, Bheerpur and Muskan Nursery Andava Allahabad and biofertilizer viz. vermicompost, neemcake, and FYM were collected from Prakriti nursery, Civil lines ,Allahabad.

3.4. Experimental Details:

There are thirteen treatments taken with different organic manure except one. This one is control treatment denotes by T₀.

3.4.1. Experimental Design:

Field experiments were designed by Randomized Block Design. Each seedling plot was planted 3mx3m distance. Total area required of Rocky site land=3159 m²=1.94 Bigha. Area of per plot=9x39= 351 m², Number of plot at rocky site =9 and Total no. of tree in per plot=39, Number of total tree at rocky site=351tree. The same requirements are found in Usar sites also. Each plot was supplemented with different organic manure and irrigation schedule.

3.4.2. Treatments combination

T ₀	Control
T ₁	When Irrigation +Farm yard manure (10kg/year/plant)
T ₂	When Irrigation + Neem cake (1kg/year/plant)
T ₃	When Irrigation +Vermicompost (2kg/year/plant)
T ₄	10 Days Interval Irrigation + Farm yard manure (10kg/year/plant)
T ₅	20 Days Interval Irrigation + Farm yard manure (10kg/year/plant)
T ₆	30 Days Interval Irrigation + Farm yard manure (10kg/year/plant)
T ₇	10 Days Interval Irrigation + Neem cake (1kg/year/plant)
T ₈	20 Days Interval Irrigation + Neem cake (1kg/year/plant)
T ₉	30 Days Interval Irrigation + Neem cake (1kg/year/plant)
T ₁₀	10 Days Interval Irrigation + Vermicompost (2kg/year/plant)
T ₁₁	20 Days Interval Irrigation + Vermicompost (2kg/year/plant)
T ₁₂	30 Days Interval Irrigation + Vermicompost (2kg/year/plant)

3.5. Observation Recorded:

The quarterly observations on growth parameters are-

- Height- with the help of inch tape
- Collar diameter- with the help of vernier calipers.
- Survival percentage:

$$\text{Survival percentage} = \frac{\text{Number of survive plants} \times 100}{\text{Total number of plants}}$$

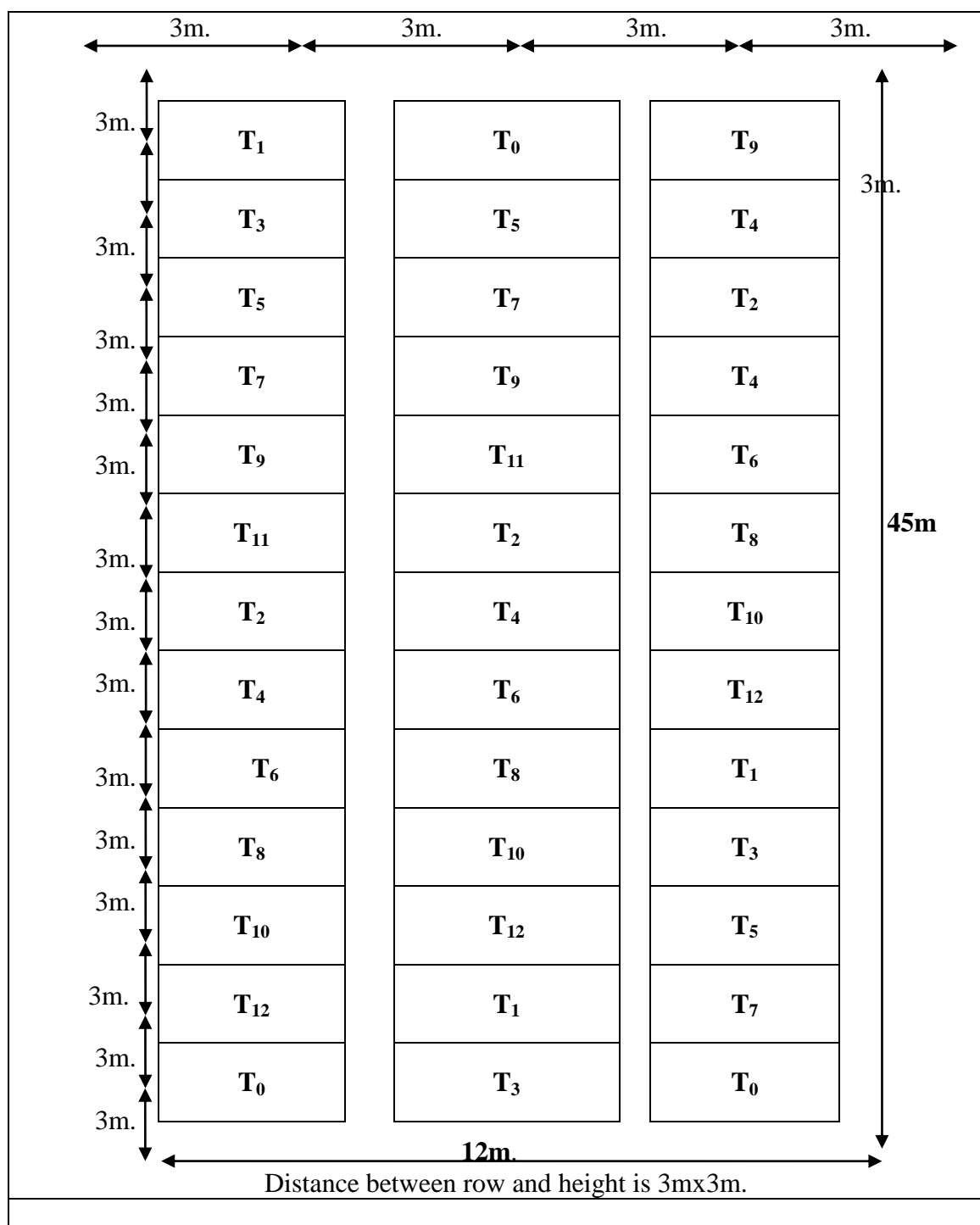


Fig.3 The layouts of plant design plantation in the field with three replications.

Height was recorded with the help of inch tape and collar diameter with the help of Vernier caliper to assess the suitable age, treatment and Irrigation effect of selected species in plantation trials.

3.6. Analysis of physico-chemical properties of the soil before and after plantation:

Standard methods were used to determine the physical and chemical analysis of soil. Soil samples in three different places were collected from each site and in each replication.

Fresh weight of the soil samples using digital weighing balance. Oven drying of soil samples to estimate the moisture contents.

Soil nutrients analysis:

Parameters	Methods
1.Organic Carbon	Walkley and Black Methods(1947)
2.Available Nitrogen	Kjeldal Method
3. Available Phosphorus	Olsen <i>et.al.</i> (1954), spectrophotometer
4. Available Potassium	Toth and Prince (1949), flame photometer
5.Soil pH	Glass Electrode Method

3.7. Statistical Analysis:

The data obtained were subjected to ANOVA, and means were compared with Duncan's multiple range test. All statistical analysis were conducted using, SPSS (Version 14; IBM, Armonk, NY, USA).

The results of the experiment entitled “**Assessment of Plant Species for Rehabilitation of wasteland in Meja Tehsil**” were discussed below. The experiment was conducted at Meja Tehsil, Allahabad, during the month of December, 2011 to November, 2012 and December, 2012 to November, 2013. Site specific technological package and growth data are presented in appropriate tables and graphs format after statistical analysis.

4.1. Six month old seedling plantation of *Carissa carandas* (Karondha) at Rocky site:

4.1.1. Increase in plant height (cm) of *Carissa carandas* (Karondha) – 6 month old seedling at Rocky site in December, 2011 to November, 2012 and December, 2012 to November, 2013.

Plant height during first year (Table 4.1.1.) -

Plant height was observed after 3 month, the maximum height was found in the treatment T₃ (0.80cm), T₁₀ (0.8cm), T₁₁ (0.8cm) and followed by T₄ (0.70cm), T₅ (0.60cm) and T₁ (0.60cm), However, minimum was recorded in T₀ (0.40cm).

Plant was observed after 6 month, the maximum height was found in the treatment T₁₀ (1.86cm) and followed by T₃ (1.63cm), T₄ (1.63cm) and T₁₁ (1.63 cm). However, minimum was recorded in T₀ (0.69cm).

Plant height was observed after 9 month, the maximum height was found in T₁₀ (6.63cm) followed by T₃ (5.30cm), T₁₁ (5.27cm), T₁ (5.23cm) and T₄ (5.23cm). However, minimum height was recorded in T₀ (3.53cm).

Plant height was observed after 12 month, the maximum height was found in T₁₀ (3.87cm) and followed by T₃ (3.80cm), T₄ (3.77cm) T₁₁ (3.77cm) and T₁ (3.73cm.). However, minimum height was recorded in T₀ (2.83cm). Other organic manure and irrigation schedule showed the significant differences in the plant height in all monthly treatment of first year.

Plant height during second year (Table 4.1.1.) -

The result of average plant height after 3 month (0.90cm) was observed maximum in the treatment T_{10} , and followed by T_3 (0.86cm), T_{11} (0.85cm) and T_4 (0.81cm), However, minimum was recorded in T_0 (0.50cm).

Plant height after 6 month (3.37cm) was observed maximum in T_{10} and followed by, T_3 (3.30cm), T_4 (3.27cm) T_{11} (3.27cm) and T_1 (2.90cm). However, minimum was recorded in T_0 (2.33cm).

Plant height after 9 month (6.53cm) was observed maximum in T_{10} and followed by T_1 (5.83cm), T_3 (6.53cm), T_{11} (6.47cm) and T_4 (6.40cm). However, minimum was recorded in T_0 (5.03cm).

Plant height after 12 month (6.03cm) was observed maximum in T_{10} and followed by T_{11} (5.17cm) T_3 (5.20cm), T_4 (5.13cm) and T_1 (4.77cm). However, minimum was recorded in T_0 (4.30cm). Other organic manure and irrigation schedule showed the significant differences in the plant height in all monthly treatment of second year.

Table 4.1.1. Increase in plant height (cm) of (cm) of six months old seedlings of Karondha (*Carissa carandas*) at Rocky site at different intervals (Year-wise)

Treatment No.	Treatment		Increase in plant height (cm) of Karondha - 6 months old seedlings - Rocky site									
	Organic manure	Irrigation schedule	December, 2011 to November, 2012					December, 2012 to November, 2013				
			3 months	6 months	9 months	12 months	Total	3 months	6 months	9 months	12 months	Total
T ₀	Control		0.40	0.69	3.53	2.83	7.46	0.50	2.33	5.03	4.30	12.16
T ₁	FYM	When required	0.60	1.54	5.23	3.73	11.11	0.76	2.90	5.83	4.77	14.26
T ₂	NC	When required	0.50	1.25	4.57	3.30	9.61	0.70	2.80	5.77	4.70	13.97
T ₃	VC	When required	0.80	1.63	5.30	3.80	11.53	0.86	3.30	6.53	5.20	15.89
T ₄	FYM	10 Days	0.70	1.63	5.23	3.77	11.33	0.81	3.27	6.40	5.13	15.61
T ₅	FYM	20 Days	0.60	1.36	4.57	3.37	9.90	0.70	2.87	5.83	4.77	14.17
T ₆	FYM	30 Days	0.40	0.73	3.53	2.83	7.49	0.50	2.33	5.03	4.30	12.16
T ₇	NC	10 Days	0.40	1.16	4.57	3.30	9.43	0.67	2.80	5.77	4.70	13.93
T ₈	NC	20 Days	0.40	1.13	4.57	3.30	9.39	0.67	2.80	5.73	4.70	13.90
T ₉	NC	30 Days	0.40	0.82	4.20	3.17	8.59	0.53	2.67	5.13	4.63	12.97
T ₁₀	VC	10 Days	0.80	1.86	6.63	3.87	13.16	0.90	3.37	6.53	6.03	16.83
T ₁₁	VC	20 Days	0.80	1.63	5.27	3.77	11.47	0.85	3.27	6.47	5.17	15.75
T ₁₂	VC	30 Days	0.40	0.85	4.53	3.17	8.95	0.60	2.67	5.70	4.63	13.60
		F- test	S	S	S	S		S	S	S	S	
		S. Ed. (\pm)	0.08	0.12	0.79	0.57		0.09	0.41	1.11	0.81	
		C. D. (P = 0.05)	0.18	0.24	1.63	1.17		0.19	0.84	2.29	1.66	

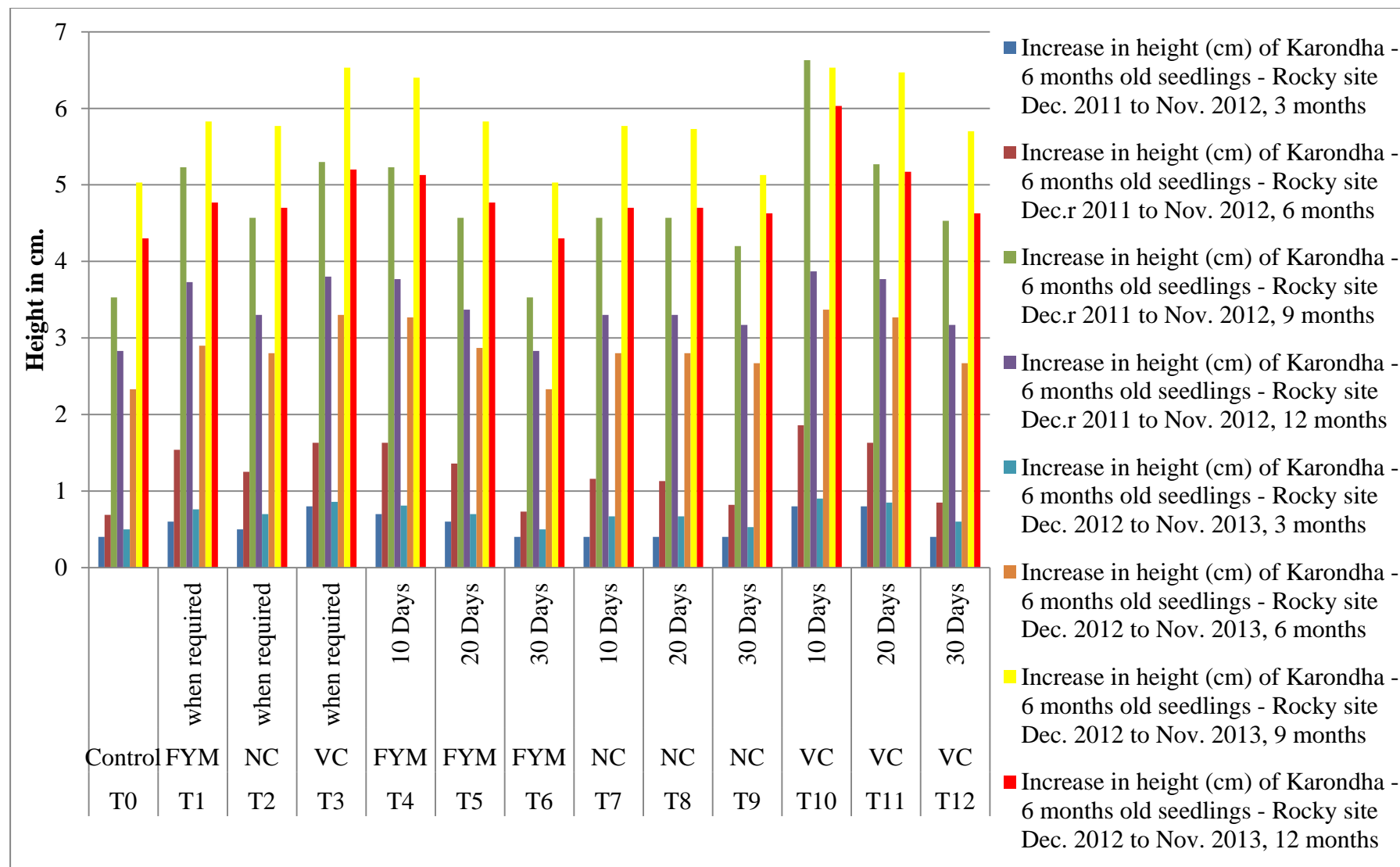


Fig. 4.1.1. Increase in plant height (cm) of six months old seedlings of Karondha at Rocky sites in December, 2011 to November, 2013.

4.1.2 Increase in Collar diameter (cm) of *Carissa carandas* (Karondha) – 6 month old seedling at Rocky site in December, 2011 to November, 2012 and December, 2012 to November, 2013.

Plant Collar diameter during first year (Table 4.1.2.) -

The result of average Collar diameter after 3 month (0.30cm) was observed maximum in the treatment T_{10} , and followed by T_{11} (0.23cm), T_3 (0.23cm) and T_4 (0.20cm), However, minimum increase Collar diameter was recorded in T_0 (0.10cm).

Collar diameter after 6 month (0.30cm) was observed maximum in T_{10} and followed by T_{11} (0.30cm), T_3 (0.30cm), T_4 (0.27cm). However, minimum increase Collar diameter was recorded in T_0 (0.17cm).

Collar diameter after 9 month (0.37cm) was observed maximum in T_{10} and followed by T_3 (0.37cm), T_{11} (0.27cm), T_1 (0.27cm) and T_4 (0.27cm). However, minimum increase Collar diameter was recorded in T_0 (0.23cm).

Collar diameter after 12 month (1.51cm) was observed maximum in T_{10} and followed by T_3 (0.44cm), T_{11} (0.40cm) and T_4 (0.37cm). However, minimum increase Collar diameter was recorded in T_0 (0.22cm). Other organic manure and irrigation schedule showed the significant differences in the plant collar diameter in all monthly treatments of first year.

Plant height during second year (Table 4.1.2.) -

The result of the average Collar diameter after 3 month (0.30cm) was observed maximum in the treatment T_{10} and followed by T_3 (0.30cm), T_{11} (0.30cm) and T_4 (0.30cm), However, minimum increase Collar diameter was recorded in T_0 (0.10cm).

Collar diameter after 6 month (0.30cm) was observed maximum in T_{10} and followed by T_3 (0.30cm), T_{11} (0.30cm), T_1 (0.27cm). However, minimum increase Collar diameter was recorded in T_0 (0.22cm).

Collar diameter after 9 month (0.45cm) was observed maximum in T₁₀ and followed by T₃(0.37cm), T₁₁(0.33cm), T₁(0.22cm) and T₄(0.27cm). However, minimum increase collar diameter was recorded in T₀ (0.22cm).

Collar diameter after 12 month (0.37cm) was observed maximum in T₁₀ and followed by T₁₁(0.30cm), T₃(0.30cm) and T₄(0.30cm). However, minimum increase Collar diameter was recorded in T₀ (0.29cm). While as other organic manure and irrigation schedule showed the significant differences in the plant collar diameter in all monthly treatment of second year.

Table 4.1.2. Increase in collar diameter (cm) of six months old seedlings of Karondha (*Carissa carandas*) at Rocky site at different intervals (Year-wise)

Treatment No.	Treatment		Increase in collar diameter (cm) of Karondha - 6 months old seedlings - Rocky site									
	Organic manure	Irrigation schedule	December, 2011 to November, 2012					December, 2012 to November, 2013				
			3 months	6 months	9 months	12 months	Total	3 months	6 months	9 months	12 months	Total
T ₀	Control		0.10	0.17	0.23	0.22	0.72	0.10	0.22	0.22	0.29	0.83
T ₁	FYM	When required	0.17	0.27	0.27	0.37	1.07	0.30	0.27	0.27	0.30	1.13
T ₂	NC	When required	0.17	0.27	0.27	0.34	1.04	0.27	0.27	0.27	0.30	1.10
T ₃	VC	When required	0.23	0.30	0.37	0.44	1.34	0.30	0.30	0.37	0.30	1.27
T ₄	FYM	10 Days	0.20	0.27	0.27	0.37	1.11	0.30	0.30	0.27	0.30	1.17
T ₅	FYM	20 Days	0.17	0.27	0.27	0.35	1.05	0.27	0.27	0.27	0.30	1.10
T ₆	FYM	30 Days	0.10	0.17	0.23	0.23	0.73	0.10	0.22	0.22	0.30	0.84
T ₇	NC	10 Days	0.16	0.23	0.23	0.29	0.92	0.27	0.27	0.27	0.30	1.10
T ₈	NC	20 Days	0.13	0.20	0.23	0.26	0.83	0.23	0.27	0.27	0.30	1.07
T ₉	NC	30 Days	0.10	0.20	0.23	0.23	0.76	0.20	0.23	0.23	0.30	0.97
T ₁₀	VC	10 Days	0.30	0.30	0.37	1.51	2.48	0.30	0.30	0.45	0.37	1.41
T ₁₁	VC	20 Days	0.23	0.30	0.27	0.40	1.20	0.30	0.30	0.33	0.30	1.23
T ₁₂	VC	30 Days	0.10	0.20	0.23	0.23	0.76	0.20	0.27	0.23	0.30	1.00
		F- test	S	S	S	S		S	S	S	S	
		S. Ed. (\pm)	0.03	0.03	0.03	0.05		0.03	0.04	0.03	0.04	
		C. D. (P = 0.05)	0.05	0.07	0.06	0.11		0.06	0.09	0.06	0.09	

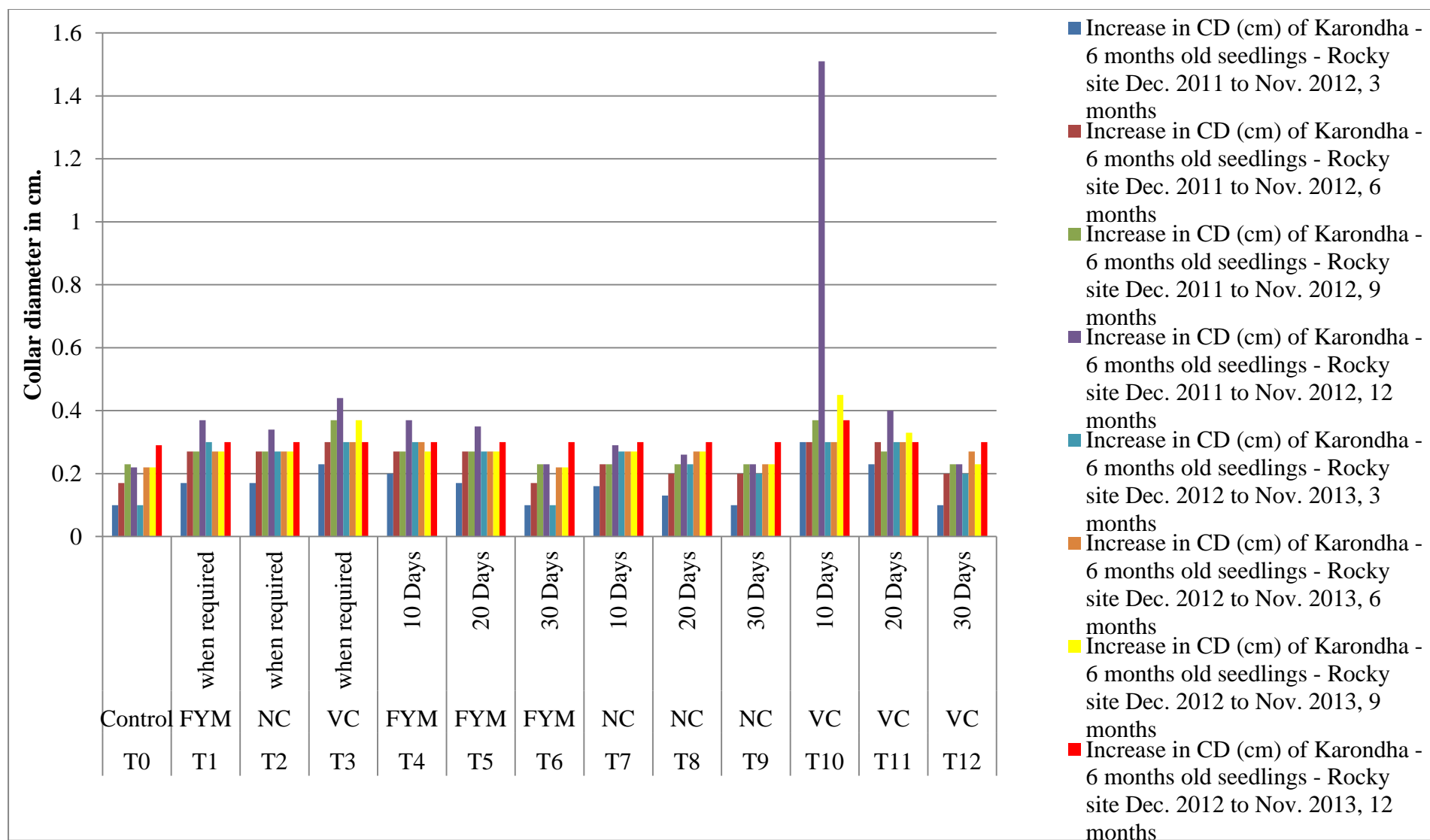


Fig. 4.1.2. Increase in Collar diameter (cm) of Karondha – 6 month old seedling at Rocky site in December, 2011 to November, 2013

4.1.3. Survival percentage of *Carissa carandas* (Karondha) - 6 months old seedling at Rocky site at different intervals in December, 2011 to November, 2012 and December, 2012 to November, 2013.

Plant Survival percentage during first year (Table 4.1.3.) -

The survivality in first year of 3, 6, 9 and 12 month reported Karondha seedlings grown at Rocky sites with different intervals of irrigation schedule along with the applications of organic manures available or provide in a form of different treatment combinations.

The result of 3 and 6 months clearly indicates non significant maximum survival percentage i.e. 100% was found in T₁, T₂, T₃, T₄ T₅, T₇, T₈, T₉, T₁₀, T₁₁ and T₁₂ due to good soil condition, nature of soil fertility availability essential minerals & nutrients, proper and good health condition of karondha seedlings and its adaptability. This followed T₀ and T₆ with 66.67 percent which shows minimum survival percentage of Karondha seedlings because of some deficiencies are found present in rocky site with decrease physical properties of soil. Overall it is observed that treatment T₁₀ (vermicompost) with 10 days of irrigation schedule with maximum survivality or survival % i.e. 100@ along with other attributes or observatory parameters would consider the best treatment combination.

While the 9 and 12 month indicates significant maximum survival percentage i.e. 100% was found in T₁, T₂, T₃, T₄ T₅, T₇, T₈, T₉, T₁₀, T₁₁ and T₁₂ due to good soil condition, nature of soil fertility availability essential minerals & nutrients, proper and good health condition of karondha seedlings and its adaptability. This followed T₆ with 66.67 percent and treatment T₀ (control) which shows (33.33%) minimum survival percentage of karondha seedlings because of some deficiencies are found present in rocky site or decrease in physical nature of soil. Overall it is observed that treatment T₁₀ (vermicompost @ 10 days of irrigation schedule) with maximum survivality or survival % i.e. 100@ along with other attributes or observatory parameters would consider the best treatment combination.

Plant Survival percentage during second year (Table 4.1.3.) -

The survivality in second year of 3, 6, 9 and 12 month intervals of Karondha seedlings grown at Rocky sites with different intervals of irrigation schedule along with

the applications of organic manures available or provide in a form of different treatment combinations clearly indicates significant maximum survival percentage i.e. 100% was found in T₁, T₂, T₃, T₄, T₅, T₇, T₈, T₉, T₁₀, T₁₁ and T₁₂ due to good soil condition, nature of soil fertility availability essential minerals & nutrients, proper and good health condition of karondha seedlings and its adaptability. This followed T₆ with 66.67 percent and treatment T₀ (control) which shows (33.33%) minimum survival percentage of karondha seedlings because of some deficiencies are found present in rocky site or decrease in physical nature of soil. Overall it is observed that treatment T₁₀ (vermicompost @ 10 days of irrigation schedule) with maximum survivality or survival % i.e. 100% along with other attributes or observatory parameters would consider the best treatment combination.

Table 4.1.3. Survival percentage of six months old seedlings of Karondha (*Carissa carandas*) at Rocky site at different intervals (Year-wise)

Treatment No.	Treatment		Survival percentage of Karondha - 6 months old seedlings - Rocky site									
			December, 2011 to November, 2012					December, 2012 to November, 2013				
	Organic manure	Irrigation schedule	3 months	6 months	9 months	12 months	Total	3 months	6 months	9 months	12 months	Total
T ₀	Control		66.67	66.67	33.33	33.33	33.33	33.33	33.33	33.33	33.33	33.33
T ₁	FYM	When required	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₂	NC	When required	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₃	VC	When required	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₄	FYM	10 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₅	FYM	20 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₆	FYM	30 Days	66.67	66.67	66.67	66.67	66.67	66.67	66.67	66.67	66.67	66.67
T ₇	NC	10 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₈	NC	20 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₉	NC	30 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₁₀	VC	10 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₁₁	VC	20 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₁₂	VC	30 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
		F- test	NS	NS	S	S		S	S	S	S	
		S. Ed. (±)	-	-	18.10	18.10		18.10	18.10	18.10	18.10	
		C. D. (P = 0.05)	-	-	37.36	37.36		37.36	37.36	37.36	37.36	

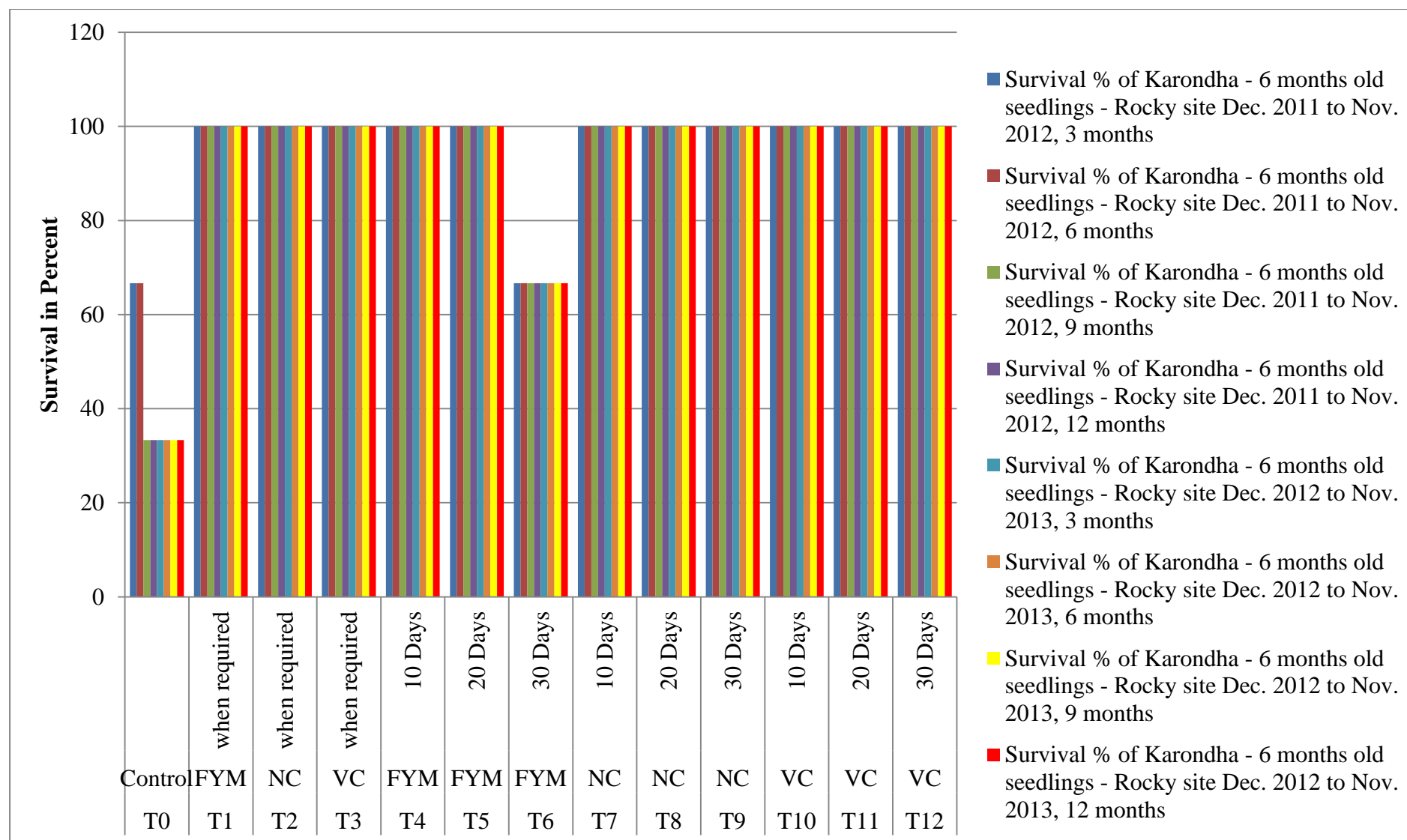


Fig. 4.1.3. Survival percentage of Karondha – 6 month old seedling at Rocky site in December, 2011 to November, 2013

4.2. One year old seedling plantation of *Carissa carandas* (Karondha) at Rocky site:

4.2.1. Increase in plant height (cm) of one year old seedling of *Carissa carandas* (Karondha) at Rocky site in December, 2011 to November, 2012 and December, 2012 to November, 2013.

Plant height during first year (Table 4.2.1.) -

The result of average plant height after 3 month (0.79cm) was observed maximum in the treatment T₁₀ and followed by T₃ (0.76cm), T₁₁ (0.75cm) and T₄ (0.70cm), However, minimum was recorded in T₀ (0.58cm).

Plant height after 6 month (1.97cm) was observed maximum in T₁₀ and followed by T₃ (1.84cm), T₁₁ (1.75cm), and T₄ (1.65cm). However, minimum was recorded in T₀ (0.92cm).

Plant height after 9 month (9.10cm) was observed maximum in T₁₀ and followed by T₃ (8.90cm), T₁₁ (8.63cm), T₄ (8.57cm) and T₁ (8.30cm). However, minimum was recorded in T₀ (5.47cm).

Plant height after 12 month (5.53cm) was observed maximum in T₁₀ and followed by T₃ (5.10cm), T₁₁ (5.07cm) and T₄ (5.00cm). However, minimum was recorded in T₀ (3.50cm). While as other organic manure and irrigation schedule showed the significant differences in the plant height in all monthly treatment of first year.

Plant height during second year (Table 4.2.1.) -

The result of average plant height after 3 month (0.87cm) was observed maximum in the treatment T₁₀ and followed by T₃ (0.77cm), T₁₁ (0.73cm) and T₄ (0.73cm), However, minimum was recorded in T₀ (0.40cm).

Plant height after 6 month (5.03cm) was observed maximum in T₁₀ and followed by T₃ (4.57cm), T₁₁ (4.53cm) and T₄ (4.40cm). However, minimum was recorded in T₀ (3.00cm).

Plant height after 9 month (10.60cm) was observed maximum in T₁₀ and followed by T₃ (10.37cm), T₁₁ (9.90cm), T₄ (9.80cm) and T₁ (9.60cm). However, minimum was recorded in T₀ (7.60cm).

Plant height after 12 month (7.17cm) was observed maximum in T₁₀ and followed by T₃ (6.70cm), T₁₁ (6.67cm) and T₄ (6.53cm). However, minimum was recorded in T₀ (5.40cm). While as other organic manure and irrigation schedule showed the significant differences in the plant height in all monthly treatment of second year.

Table 4.2.1. Increase in plant height (cm) of one year old seedlings of Karondha (*Carissa carandas*) at Rocky site at different intervals (Year-wise)

Treatment No.	Treatment		Increase in plant height (cm) of Karondha - one year old seedlings - Rocky site									
	Organic manure	Irrigation schedule	December, 2011 to November, 2012					December, 2012 to November, 2013				
			3 months	6 months	9 months	12 months	Total	3 months	6 months	9 months	12 months	Total
T ₀	Control		0.58	0.92	5.47	3.50	10.47	0.40	3.00	7.60	5.40	16.40
T ₁	FYM	When required	0.70	1.54	8.30	4.97	15.51	0.70	4.37	9.60	6.47	21.13
T ₂	NC	When required	0.69	1.51	7.50	4.73	14.43	0.70	4.17	9.43	6.30	20.60
T ₃	VC	When required	0.76	1.84	8.90	5.10	16.60	0.77	4.57	10.37	6.70	22.40
T ₄	FYM	10 Days	0.70	1.65	8.57	5.00	15.92	0.73	4.40	9.80	6.53	21.47
T ₅	FYM	20 Days	0.70	1.51	7.53	4.80	14.54	0.70	4.23	9.53	6.37	20.83
T ₆	FYM	30 Days	0.58	0.99	5.47	3.50	10.54	0.40	3.00	7.60	5.40	16.40
T ₇	NC	10 Days	0.68	1.34	7.37	4.57	13.95	0.67	4.03	9.37	6.00	20.07
T ₈	NC	20 Days	0.65	1.24	7.33	4.33	13.56	0.63	3.83	9.27	5.80	19.53
T ₉	NC	30 Days	0.60	0.96	6.13	4.03	11.73	0.43	3.47	7.73	5.67	17.30
T ₁₀	VC	10 Days	0.79	1.97	9.10	5.53	17.40	0.87	5.03	10.60	7.17	23.67
T ₁₁	VC	20 Days	0.75	1.75	8.63	5.07	16.20	0.73	4.53	9.90	6.67	21.83
T ₁₂	VC	30 Days	0.65	1.05	6.77	4.17	12.63	0.47	3.67	8.93	5.77	18.83
		F- test	S	S	S	S		S	S	S	NS	
		S. Ed. (\pm)	0.01	0.06	0.93	0.55		0.06	0.41	1.16	-	
		C. D. (P = 0.05)	0.03	0.13	1.92	1.14		0.13	0.85	2.40	-	

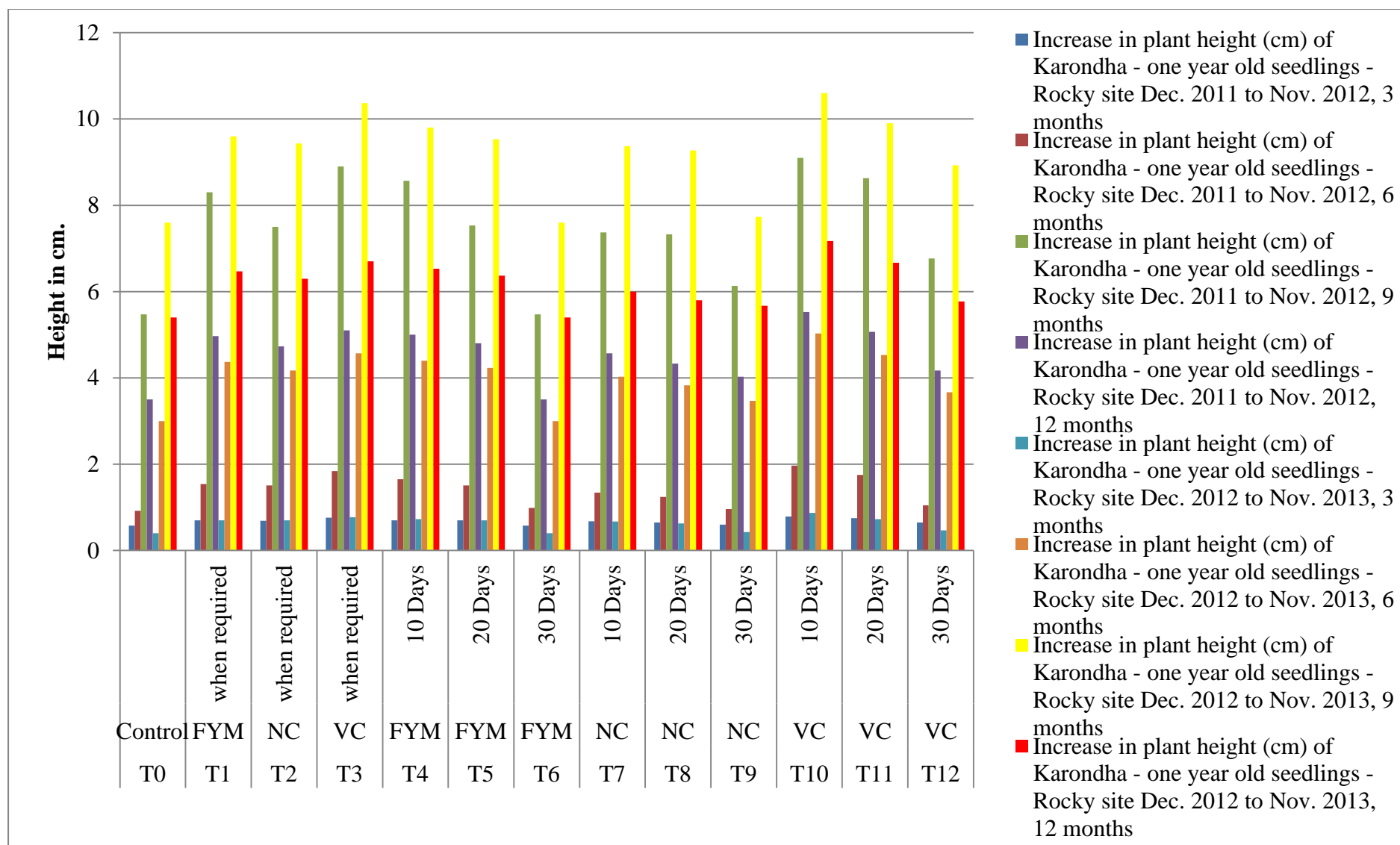


Fig.4.2.1. Increase in plant height (cm) of one year old seedlings of Karondha at Rocky sites in December, 2011 to November, 2013

4.2.2. Increase in Collar diameter (cm) of one year old seedling of *Carissa carandas* (Karondha) at Rocky site in December, 2011 to November, 2012 and December, 2012 to November, 2013.

Plant Collar diameter during first year (Table 4.2.2.) -

The result of the average Collar diameter after 3 month (0.27cm) was observed maximum in the treatment T_{10} and followed by T_3 (0.27cm), T_{11} (0.27cm) and T_4 (0.23cm), However, minimum increase Collar diameter (0.10cm) was recorded in T_0 .

Collar diameter after 6 month increase Collar diameter (0.37cm) was observed maximum in T_{10} and followed by T_3 (0.37cm), T_{11} (0.33cm), T_4 (0.33cm). However, minimum increase Collar diameter was recorded in T_0 (0.23cm).

Collar diameter after 9 month (0.50cm) was observed maximum in T_{10} and followed by T_3 (0.50cm), T_{11} (0.50cm), T_1 (0.47cm) and T_4 (0.50cm). However, minimum increase Collar diameter was recorded in T_0 (0.23cm).

Collar diameter after 12 month (0.64cm) was observed maximum in T_{10} and followed by T_3 (0.64cm), T_{11} (0.61cm) and T_4 (0.58cm). However, minimum increase Collar diameter was recorded in T_0 (0.23cm). While as other organic manure and irrigation schedule showed the significant differences in the plant collar diameter in all monthly treatment of first year.

Plant Collar diameter during second year (Table 4.2.2.) -

The result of the average Collar diameter after 3 month (0.40cm) was observed maximum in the treatment T_{10} and followed by T_3 (0.40cm), T_{11} (0.40cm) and T_4 (0.37cm), However, minimum increase Collar diameter was recorded in T_0 (0.27cm).

Collar diameter after 6 month (0.37cm) was observed maximum in T_{10} and followed by T_3 (0.33cm), T_{11} (0.30cm), T_4 (0.30cm). However, minimum increase Collar diameter was recorded in T_0 (0.27cm). While as other organic manure and irrigation schedule showed the significant differences in the plant collar diameter.

Collar diameter after 9 month (0.53cm) was observed maximum in T_{10} and followed by T_3 (0.50cm), T_{11} (0.50cm), T_1 (0.50cm) and T_4 (0.50cm). However, minimum increase Collar diameter was recorded in T_0 (0.23cm).

Collar diameter after 12 month (0.50cm) was observed maximum in T₁₀ and followed by T₃ (0.51cm), T₄ (0.50cm) and T₁₁ (0.49cm). However, minimum increase Collar diameter was recorded in T₀ (0.30cm). While as other organic manure and irrigation schedule showed the significant differences in the plant collar diameter in all monthly treatment of second year.

Table 4.2.2. Increase in collar diameter (cm) of one year old seedlings of Karondha (*Carissa carandas*) at Rocky site at different intervals (Year-wise)

Treatment No.	Treatment		Increase in collar diameter (cm) of Karondha - one year old seedlings - Rocky site									
	Organic manure	Irrigation schedule	December, 2011 to November, 2012					December, 2012 to November, 2013				
			3 months	6 months	9 months	12 months	Total	3 months	6 months	9 months	12 months	Total
T ₀	Control		0.10	0.23	0.23	0.23	0.80	0.27	0.27	0.23	0.30	1.07
T ₁	FYM	When required	0.20	0.33	0.47	0.57	1.57	0.37	0.30	0.50	0.47	1.63
T ₂	NC	When required	0.15	0.27	0.47	0.47	1.35	0.37	0.27	0.50	0.40	1.53
T ₃	VC	When required	0.27	0.37	0.50	0.64	1.78	0.40	0.33	0.50	0.51	1.75
T ₄	FYM	10 Days	0.23	0.33	0.50	0.58	1.65	0.37	0.30	0.50	0.50	1.67
T ₅	FYM	20 Days	0.20	0.30	0.47	0.51	1.48	0.37	0.30	0.50	0.40	1.57
T ₆	FYM	30 Days	0.10	0.27	0.23	0.28	0.88	0.27	0.27	0.23	0.37	1.13
T ₇	NC	10 Days	0.13	0.27	0.37	0.43	1.19	0.30	0.27	0.47	0.40	1.43
T ₈	NC	20 Days	0.10	0.27	0.37	0.40	1.13	0.30	0.27	0.43	0.38	1.38
T ₉	NC	30 Days	0.10	0.27	0.23	0.29	0.89	0.27	0.27	0.27	0.37	1.17
T ₁₀	VC	10 Days	0.27	0.37	0.50	0.64	1.78	0.40	0.37	0.53	0.50	1.80
T ₁₁	VC	20 Days	0.27	0.33	0.50	0.61	1.71	0.40	0.30	0.50	0.49	1.69
T ₁₂	VC	30 Days	0.10	0.27	0.23	0.33	0.93	0.27	0.27	0.30	0.37	1.20
		F- test	S	S	S	S		S	S	S	S	
		S. Ed. (±)	0.02	0.01	0.02	0.08		0.05	0.04	0.02	0.03	
		C. D. (P = 0.05)	0.05	0.03	0.05	0.17		0.10	0.09	0.05	0.07	

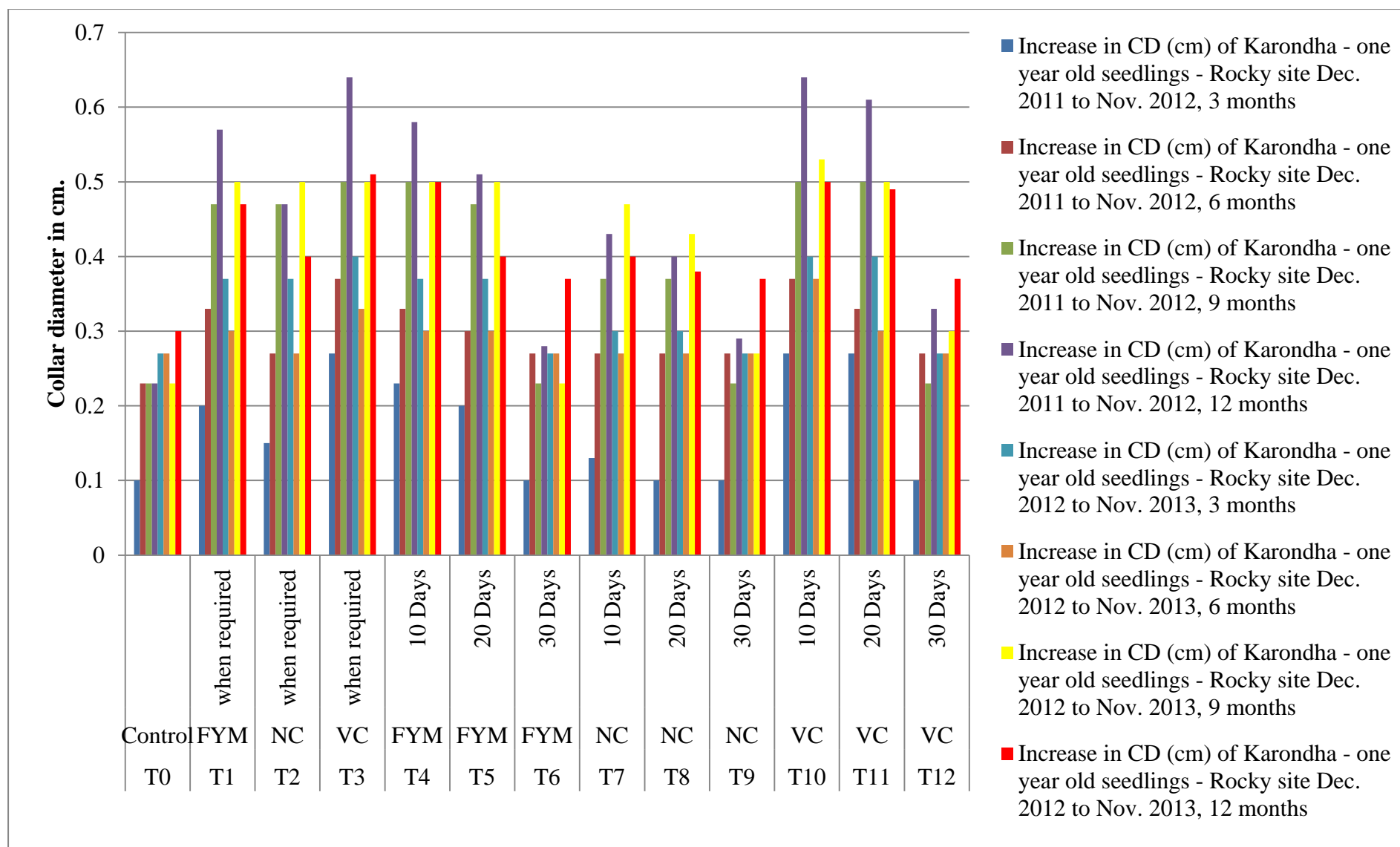


Fig. 4.2.2. Increase in Collar diameter (cm) of one year old seedling of Karondha at Rocky site in December, 2011 to November, 2013

4.2.3. Survival percentage of *Carissa carandas* (Karondha) - one year old seedling at Rocky site at different intervals in December, 2011 to November, 2012 and December, 2012 to November, 2013.

Plant Survival percentage during first year (Table 4.2.3.) -

The survivality in first year of 3 and 6 month reported Karondha seedlings grown at Rocky sites with different intervals of irrigation schedule along with the applications of organic manures available or provide in a form of different treatment combinations.

The result indicates non significant maximum survival percentage i.e. 100% was found in T₀, T₁, T₂, T₃, T₄, T₅, T₆, T₇, T₈, T₉, T₁₀, T₁₁ and T₁₂ due to good soil condition, nature of soil fertility availability essential minerals & nutrients, proper and good health condition of karondha seedlings and its adaptability.

The survivality in first year of 9 and 12 month reported Karondha seedlings grown at Rocky sites with different intervals of irrigation schedule along with the applications of organic manures available or provide in a form of different treatment combinations. Overall it is observed that treatment T₁₀ (vermicompost @ 10 days of irrigation schedule) with maximum survivality or survival % i.e. 100% along with other attributes or observatory parameters would consider the best treatment combination.

Plant Survival percentage during second year (Table 4.2.3.) -

The survivality in second year of 3, 6, 9 and 12 month reported Karondha seedlings grown at Rocky sites with different intervals of irrigation schedule along with the applications of organic manures available or provide in a form of different treatment combinations.

The study clearly indicates non significant maximum survival percentage i.e. 100% was found in T₁, T₂, T₃, T₄, T₅, T₆, T₇, T₈, T₉, T₁₀, T₁₁ and T₁₂ due to good soil condition, nature of soil fertility availability essential minerals & nutrients, proper and good health condition of karondha seedlings and its adaptability. This followed T₀ with 66.67 percent which shows minimum survival percentage of Karondha seedlings because of some deficiencies are found present in rocky site with decrease physical properties of soil. Overall it is observed that treatment T₁₀ (vermicompost @ 10 days of

irrigation schedule) with maximum survivality or survival % i.e. 100@ along with other attributes or observatory parameters would consider the best treatment combination.

Table 4.2.3. Survival percentage of one year old seedlings of Karondha (*Carissa carandas*) at Rocky site at different intervals (Year-wise)

Treatment No.	Treatment		Survival percentage of Karondha - one year old seedlings - Rocky site									
			December, 2011 to November, 2012					December, 2012 to November, 2013				
	Organic manure	Irrigation schedule	3 months	6 months	9 months	12 months	Total	3 months	6 months	9 months	12 months	Total
T ₀	Control		100.00	100.00	66.67	66.67	66.67	66.67	66.67	66.67	66.67	66.67
T ₁	FYM	When required	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₂	NC	When required	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₃	VC	When required	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₄	FYM	10 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₅	FYM	20 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₆	FYM	30 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₇	NC	10 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₈	NC	20 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₉	NC	30 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₁₀	VC	10 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₁₁	VC	20 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₁₂	VC	30 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
		F- test	NS	NS	NS	NS		NS	NS	NS	NS	
		S. Ed. (\pm)	-	-	-	-		-	-	-	-	
		C. D. (P = 0.05)	-	-	-	-		-	-	-	-	

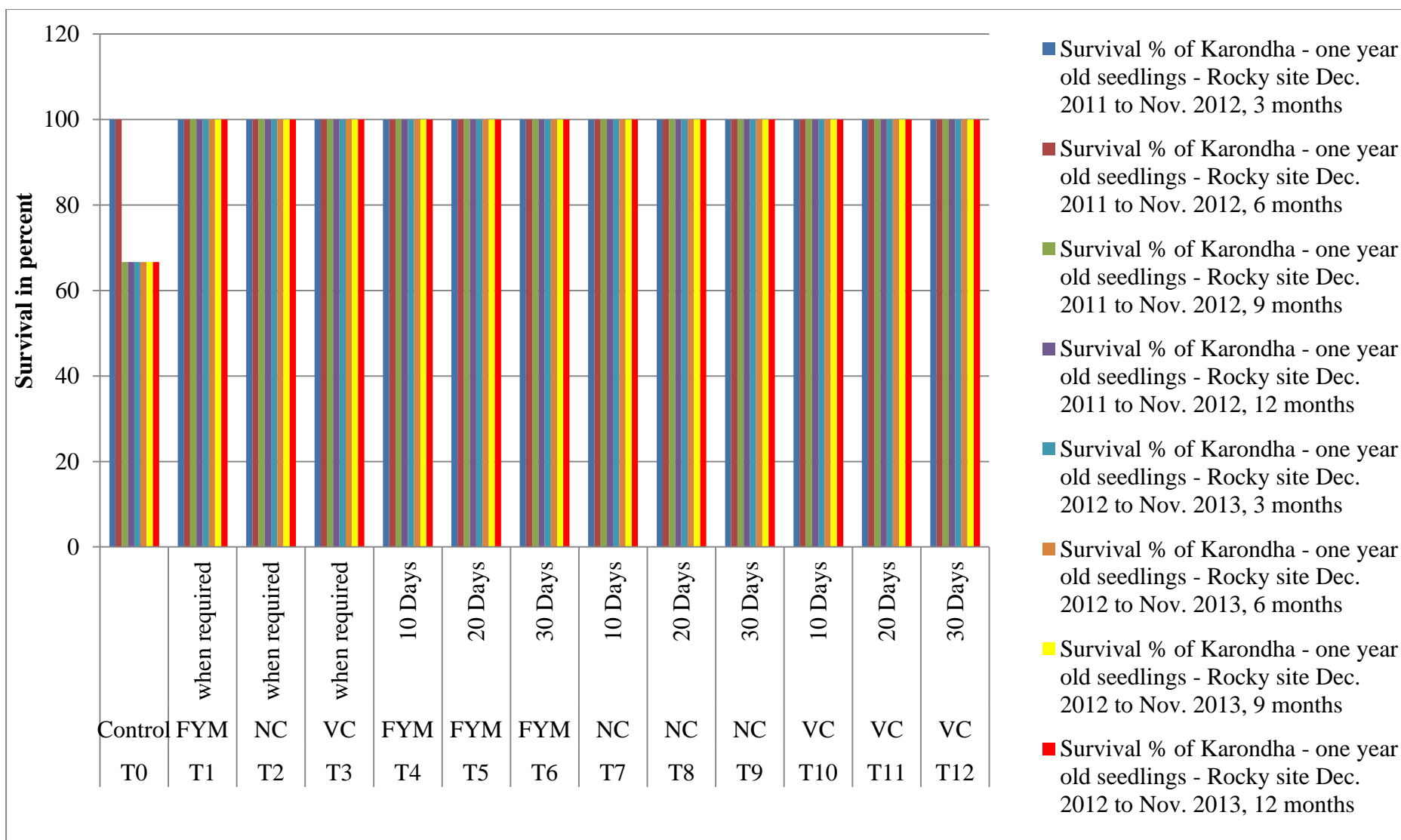


Fig. 4.2.3. Survival percentage of one year old seedling of Karondha at Rocky site in December, 2011 to November, 2013

4.3. Two year old seedling plantation of *Carissa carandas* (Karondha) at Rocky site:

4.3.1. Increase in plant height (cm) of two year old seedling of *Carissa carandas* (Karondha) at Rocky site in December, 2011 to November, 2012 and December, 2012 to November, 2013

Plant height during first year (Table 4.3.1.) -

The result of the average plant height after 3 month (0.90cm) was observed maximum in the treatment T₁₀ and followed by T₃ (0.86cm), T₁₁ (0.83cm) and T₄ (0.81cm), However, minimum was recorded in T₀ (0.53cm).

Plant height after 6 month (2.42cm) was observed maximum in T₁₀ and followed by T₃ (2.30cm), T₁₁ (2.03cm) and T₄ (1.91cm). However, minimum was recorded in T₀ (0.83cm).

Plant height after 9 month (9.40cm) was observed maximum in T₁₀ and followed by T₃ (9.17cm), T₁₁ (8.90cm) and T₁ (8.27cm). However, minimum was recorded in T₀ (6.60cm).

Plant height after 12 month (5.43cm) was observed maximum in T₁₀ and followed by T₁₁ (5.37cm), T₃ (5.37cm) and T₄ (5.27cm). However, minimum was recorded in T₀ (3.43cm). Other organic manure and irrigation schedule showed the significant differences in the plant height in all monthly treatment in first year.

Plant height during second year (Table 4.3.1.)

Plant height after 3 month (1.05cm) was observed maximum in the treatment T₁₀ and followed by T₃ (0.91cm), T₁₁ (0.90cm) and T₄ (0.90cm). However, minimum was recorded in T₀ (0.50cm).

Plant height after 6 month (4.90cm) was observed maximum in T₁₀ and followed by T₃ (4.83cm), T₁₁ (4.83cm), and T₄ (4.73cm). However, minimum was recorded in T₀ (2.90cm).

Plant height after 9 month (12.74cm) was observed maximum in T₁₀ and followed by T₃ (12.36cm), T₁₁ (12.12cm), T₁ (11.57cm) and T₄ (0.53cm). However, minimum was recorded in T₀ (8.22cm).

Plant height after 12 month (7.55cm) was observed maximum in T₁₀ and followed by T₃ (7.39cm), T₁₁ (7.28cm) and T₄ (7.15cm). However, minimum was recorded in T₀ (5.33cm). Other organic manure and irrigation schedule showed the significant differences in the plant height in all monthly treatment of second year.

Table 4.3.1. Increase in plant height (cm) of two years old seedlings of Karondha (*Carissa carandas*) at Rocky site at different intervals (Year-wise)

Treatment No.	Treatment		Increase in plant height (cm) of Karondha - two years old seedlings - Rocky site									
	Organic manure	Irrigation schedule	December, 2011 to November, 2012					December, 2012 to November, 2013				
			3 months	6 months	9 months	12 months	Total	3 months	6 months	9 months	12 months	Total
T ₀	Control		0.53	0.83	6.60	3.43	11.39	0.50	2.90	8.22	5.33	16.95
T ₁	FYM	When required	0.79	1.79	8.27	5.13	15.98	0.80	4.53	11.57	7.11	24.01
T ₂	NC	When required	0.70	1.54	8.13	4.87	15.24	0.79	4.27	11.25	6.90	23.20
T ₃	VC	When required	0.86	2.30	9.17	5.37	17.69	0.91	4.83	12.36	7.39	25.49
T ₄	FYM	10 Days	0.81	1.91	8.76	5.27	16.75	0.90	4.73	11.93	7.15	24.71
T ₅	FYM	20 Days	0.74	1.72	8.20	4.93	15.60	0.80	4.37	11.53	7.01	23.71
T ₆	FYM	30 Days	0.53	0.86	6.60	3.43	11.43	0.50	2.90	8.22	5.33	16.96
T ₇	NC	10 Days	0.67	1.48	8.03	4.50	14.69	0.69	3.90	11.06	6.83	22.48
T ₈	NC	20 Days	0.66	1.31	7.93	4.23	14.13	0.68	3.70	11.02	6.41	21.81
T ₉	NC	30 Days	0.61	0.83	7.37	3.50	12.30	0.60	2.97	9.35	5.79	18.71
T ₁₀	VC	10 Days	0.90	2.42	9.40	5.43	18.16	1.05	4.90	12.74	7.55	26.23
T ₁₁	VC	20 Days	0.83	2.03	8.90	5.37	17.13	0.90	4.83	12.12	7.28	25.13
T ₁₂	VC	30 Days	0.61	0.99	7.47	3.87	12.94	0.60	3.37	10.27	5.88	20.11
		F- test	S	S	S	S		S	S	S	S	
		S. Ed. (±)	0.01	0.10	1.35	0.70		0.09	0.43	1.70	1.16	
		C. D. (P = 0.05)	0.02	0.20	2.78	1.45		0.18	0.88	3.50	2.39	

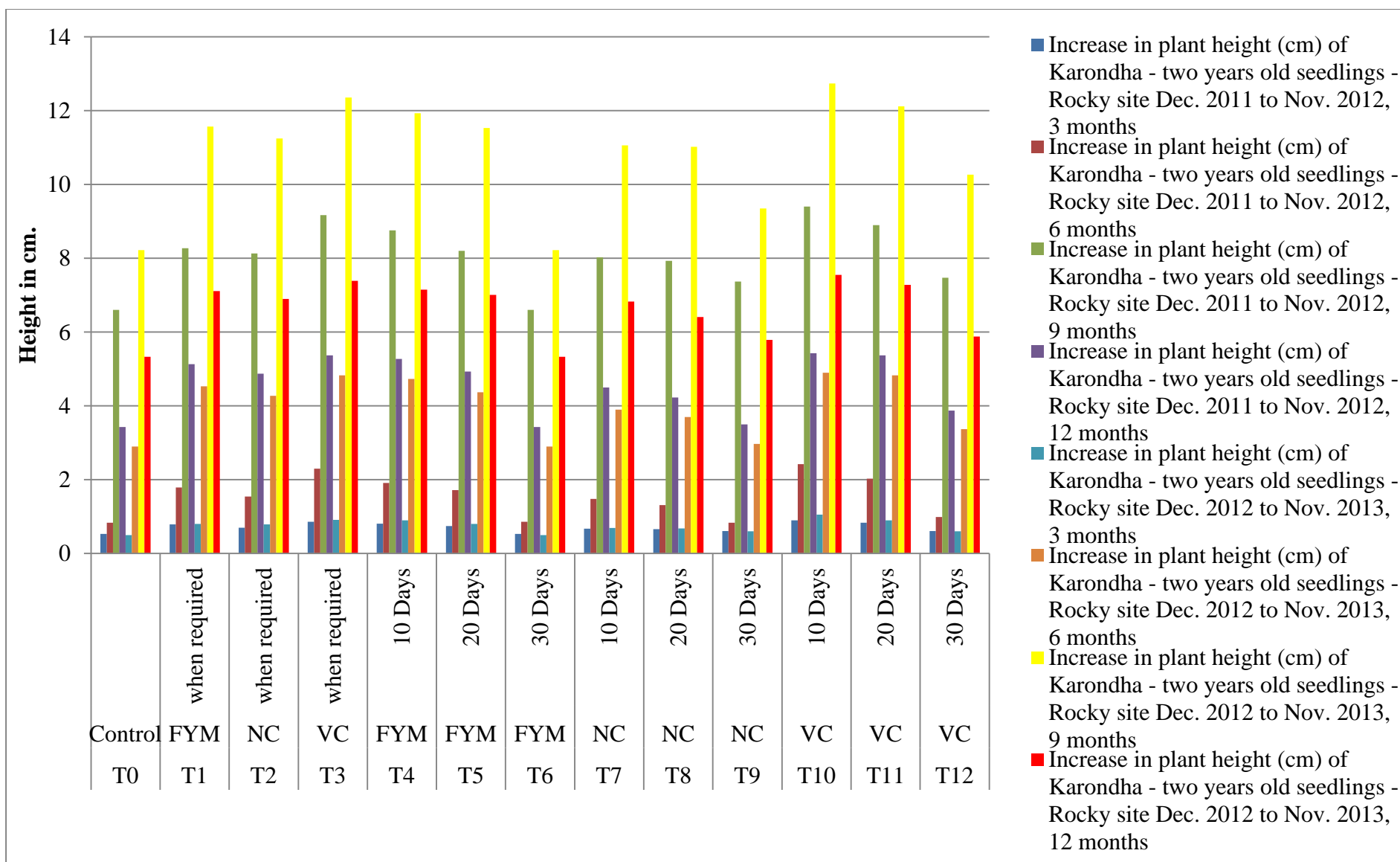


Fig. 4.3.1. Increase in plant height (cm) of two year old seedling of Karondha at Rocky sites in December, 2011 to November, 2013

4.3.2. Increase in Collar diameter (cm) of two year old seedling of *Carissa carandas* (Karondha) at Rocky site in December, 2011 to November, 2012 and December, 2012 to November, 2013.

Plant Collar diameter during first year (Table 4.3.2.) -

Collar diameter after 3 month (0.33cm) was observed maximum in the treatment T₁₀ and followed by T₃ (0.30cm), T₁₁ (0.30cm) and T₄ (0.30cm) , However, minimum increase Collar diameter was recorded in T₀ (0.13cm).

Collar diameter after 6 month (0.43cm) was observed maximum in T₁₀ and followed by T₃ (0.40cm), T₁₁ (0.40cm), T₄ (0.40cm). However, minimum increase Collar diameter was recorded in T₀ (0.27cm).

Collar diameter after 9 month (0.70cm) was observed maximum in T₁₀ and followed by T₃ (0.40cm), T₁₁ (0.40cm), T₁ (0.40cm) and T₄ (0.40cm). However, minimum increase Collar diameter) was recorded in T₀ (0.43cm.)

Collar diameter after 12 month (0.77cm) was observed maximum in T₁₀ and followed by T₃ (0.40cm), T₁₁ (0.40cm) and T₄ (0.37cm). However, minimum increase Collar diameter was recorded in T₀ (0.31cm). Other organic manure and irrigation schedule showed the significant differences in the plant collar diameter in all monthly treatment in first year.

Plant Collar diameter during second year (Table 4.3.2.) -

The result of the average Collar diameter after 3 month (0.40cm) was observed maximum in the treatment T₁₀ and followed by T₃ (0.40cm), T₁₁ (0.40cm) and T₄ (0.40cm), However, minimum increase Collar diameter was recorded in T₀ (0.30cm).

Collar diameter after 6 month (0.40cm) was observed maximum in T₁₀ and followed by T₃ (0.40cm), T₁₁ (0.40cm), T₄ (0.37cm). However, minimum increase Collar diameter was recorded in T₀ (0.27m).

Collar diameter after 9 month (0.73cm) was observed maximum in T₁₀ and followed by T₃ (0.73cm), T₁₁ (0.73cm), T₁ (0.70cm) and T₄ (0.70cm). However, minimum increase Collar diameter was recorded in T₀ (0.47cm).

Collar diameter after 12 month (0.66cm) was observed maximum in T₁₀ and followed by T₃ (0.65cm), T₁₁ (0.61cm) and T₄ (0.50cm). However, minimum increase Collar diameter was recorded in T₀ (0.40cm). Other organic manure and irrigation schedule showed the significant differences in the plant collar diameter in all monthly treatment of second year.

Table 4.3.2. Increase in collar diameter (cm) of two years old seedlings of Karondha (*Carissa carandas*) at Rocky site at different intervals (Year-wise)

Treatment No.	Treatment		Increase in collar diameter (cm) of Karondha - two years old seedlings - Rocky site									
	Organic manure	Irrigation schedule	December, 2011 to November, 2012					December, 2012 to November, 2013				
			3 months	6 months	9 months	12 months	Total	3 months	6 months	9 months	12 months	Total
T ₀	Control		0.13	0.27	0.43	0.31	1.14	0.30	0.27	0.47	0.40	1.44
T ₁	FYM	When required	0.27	0.37	0.70	0.63	1.96	0.40	0.37	0.70	0.50	1.97
T ₂	NC	When required	0.23	0.33	0.70	0.53	1.80	0.37	0.30	0.67	0.48	1.81
T ₃	VC	When required	0.30	0.40	0.70	0.71	2.11	0.40	0.40	0.73	0.65	2.18
T ₄	FYM	10 Days	0.30	0.40	0.70	0.68	2.08	0.40	0.37	0.70	0.50	1.97
T ₅	FYM	20 Days	0.27	0.37	0.70	0.59	1.92	0.37	0.37	0.67	0.48	1.88
T ₆	FYM	30 Days	0.13	0.27	0.43	0.41	1.24	0.30	0.30	0.47	0.40	1.47
T ₇	NC	10 Days	0.20	0.33	0.70	0.51	1.75	0.37	0.30	0.67	0.48	1.81
T ₈	NC	20 Days	0.20	0.33	0.60	0.49	1.62	0.33	0.30	0.67	0.48	1.78
T ₉	NC	30 Days	0.13	0.27	0.43	0.41	1.24	0.30	0.30	0.47	0.40	1.47
T ₁₀	VC	10 Days	0.33	0.43	0.70	0.77	2.24	0.40	0.40	0.73	0.66	2.19
T ₁₁	VC	20 Days	0.30	0.40	0.70	0.68	2.08	0.40	0.40	0.73	0.61	2.15
T ₁₂	VC	30 Days	0.19	0.30	0.47	0.42	1.38	0.30	0.30	0.50	0.47	1.57
		F- test	S	S	S	S		S	S	S	S	
		S. Ed. (\pm)	0.02	0.03	0.06	0.08		0.07	0.05	0.07	0.05	
		C. D. (P = 0.05)	0.03	0.06	0.12	0.16		0.14	0.11	0.14	0.11	

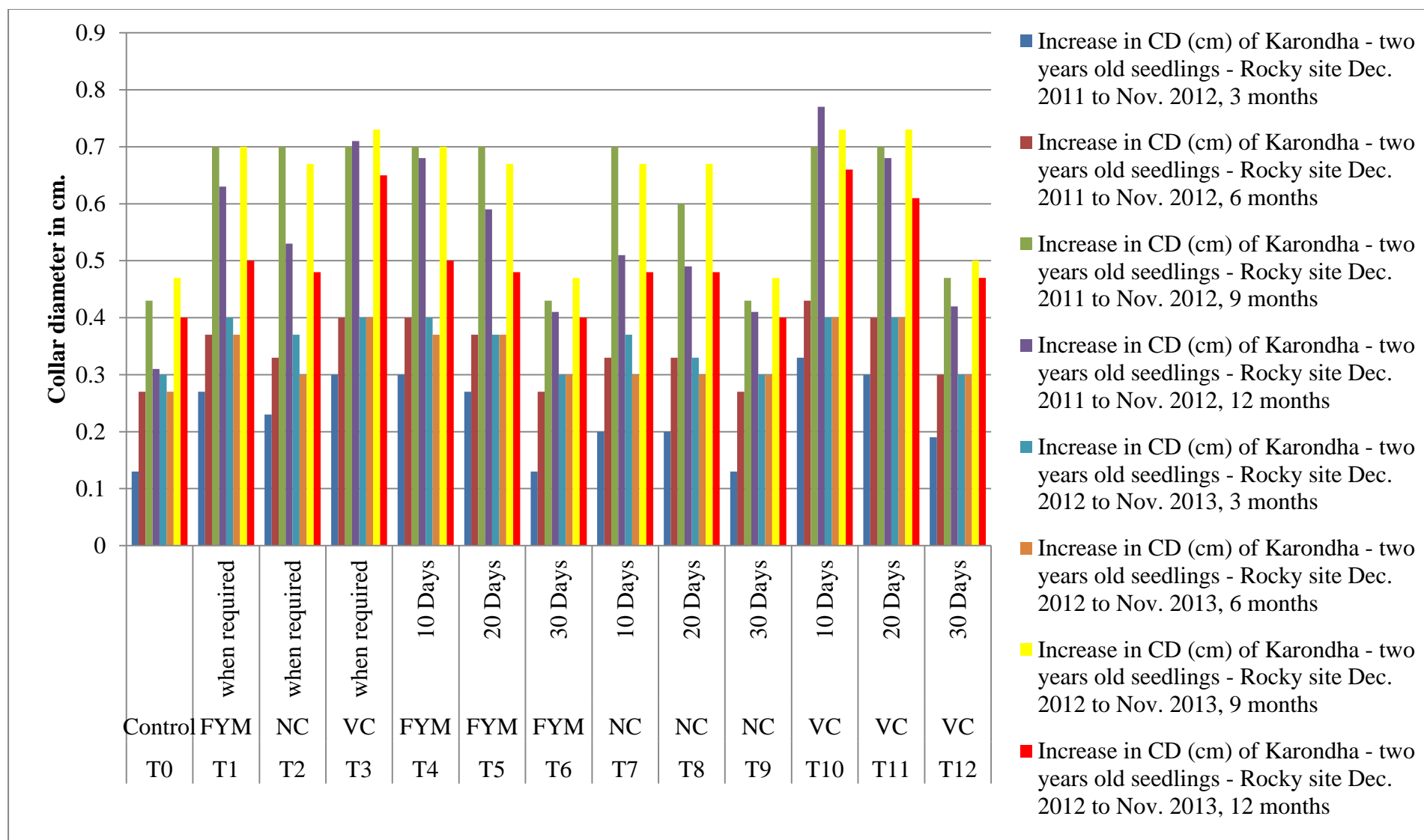


Fig. 4.3.2. Increase in Collar diameter (cm) of two year old seedling of Karondha at Rocky sites in December, 2011 to November, 2013

4.3.3. Survival percentage of *Carissa carandas* (Karondha) – two year old seedling at Rocky site at different intervals in December, 2011 to November, 2012 and December, 2012 to November, 2013.

Plant Survival percentage during first year (Table 4.3.3.) -

The survivality in first year of 3 and 6 month reported Karondha seedlings grown at rocky sites with different intervals of irrigation schedule along with the applications of organic manures available or provide in a form of different treatment combinations.

The study clearly indicates non significant maximum survival percentage i.e. 100% was found in T₀, T₁, T₂, T₃, T₄ T₅, T₆, T₇, T₈, T₉, T₁₀, T₁₁ and T₁₂ due to good soil condition, nature of soil fertility availability essential minerals & nutrients, proper and good health condition of karondha seedlings and its adaptability. Overall it is observed that treatment T₁₀ (vermicompost @ 10 days of irrigation schedule) with maximum survivality or survival % i.e. 100@ along with other attributes or observatory parameters would consider the best treatment combination.

The survivality in first year of 9 and 12 month reported Karondha seedlings grown at rocky sites with different intervals of irrigation schedule along with the applications of organic manures available or provide in a form of different treatment combinations.

The study clearly indicates non significant maximum survival percentage i.e. 100% was found in T₁, T₂, T₃, T₄ T₅, T₇, T₈, T₉, T₁₀, T₁₁ and T₁₂ due to good soil condition, nature of soil fertility availability essential minerals & nutrients, proper and good health condition of karondha seedlings and its adaptability. This followed T₆ with 66.67 percent and treatment T₀ (control) which shows (33.33%) minimum survival percentage of karondha seedlings because of some deficiencies are found present in usar site or decrease in physical nature of soil. Overall it is observed that treatment T₁₀ (vermicompost @ 10 days of irrigation schedule) with maximum survivality or survival % i.e. 100@ along with other attributes or observatory parameters would consider the best treatment combination.

Plant Survival percentage during second year (Table 4.3.3.) -

The survivality in second year of 3, 6, 9 and 12 month reported Karondha seedlings grown at rocky sites with different intervals of irrigation schedule along with the applications of organic manures available or provide in a form of different treatment combinations.

The study clearly indicates non significant maximum survival percentage i.e. 100% was found in T₁, T₂, T₃, T₄ T₅, T₇, T₈, T₉, T₁₀, T₁₁ and T₁₂ due to good soil condition, nature of soil fertility availability essential minerals & nutrients, proper and good health condition of karondha seedlings and its adaptability. This followed T₆ with 66.67 percent and treatment T₀ (control) which shows (33.33%) minimum survival percentage of karondha seedlings because of some deficiencies are found present in usar site or decrease in physical nature of soil. Overall it is observed that treatment T₁₀ (vermicompost @ 10 days of irrigation schedule) with maximum survivality or survival % i.e. 100@ along with other attributes or observatory parameters would consider the best treatment combination.

Table 4.3.3. Survival percentage of two years old seedlings of Karondha (*Carissa carandas*) at Rocky site at different intervals (Year-wise)

Treatment No.	Treatment		Survival percentage of Karondha - two years old seedlings - Rocky site									
	Organic manure	Irrigation schedule	December, 2011 to November, 2012					December, 2012 to November, 2013				
			3 months	6 months	9 months	12 months	Total	3 months	6 months	9 months	12 months	Total
T ₀	Control		100.00	100.00	33.33	33.33	33.33	33.33	33.33	33.33	33.33	33.33
T ₁	FYM	When required	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₂	NC	When required	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₃	VC	When required	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₄	FYM	10 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₅	FYM	20 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₆	FYM	30 Days	100.00	100.00	66.67	66.67	66.67	66.67	66.67	66.67	66.67	66.67
T ₇	NC	10 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₈	NC	20 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₉	NC	30 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₁₀	VC	10 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₁₁	VC	20 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₁₂	VC	30 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
		F- test	NS	NS	S	S		S	S	S	S	
		S. Ed. (±)	-	-	18.10	18.10		18.10	18.10	18.10	18.10	
		C. D. (P = 0.05)	-	-	37.36	37.36		37.36	37.36	37.36	37.36	

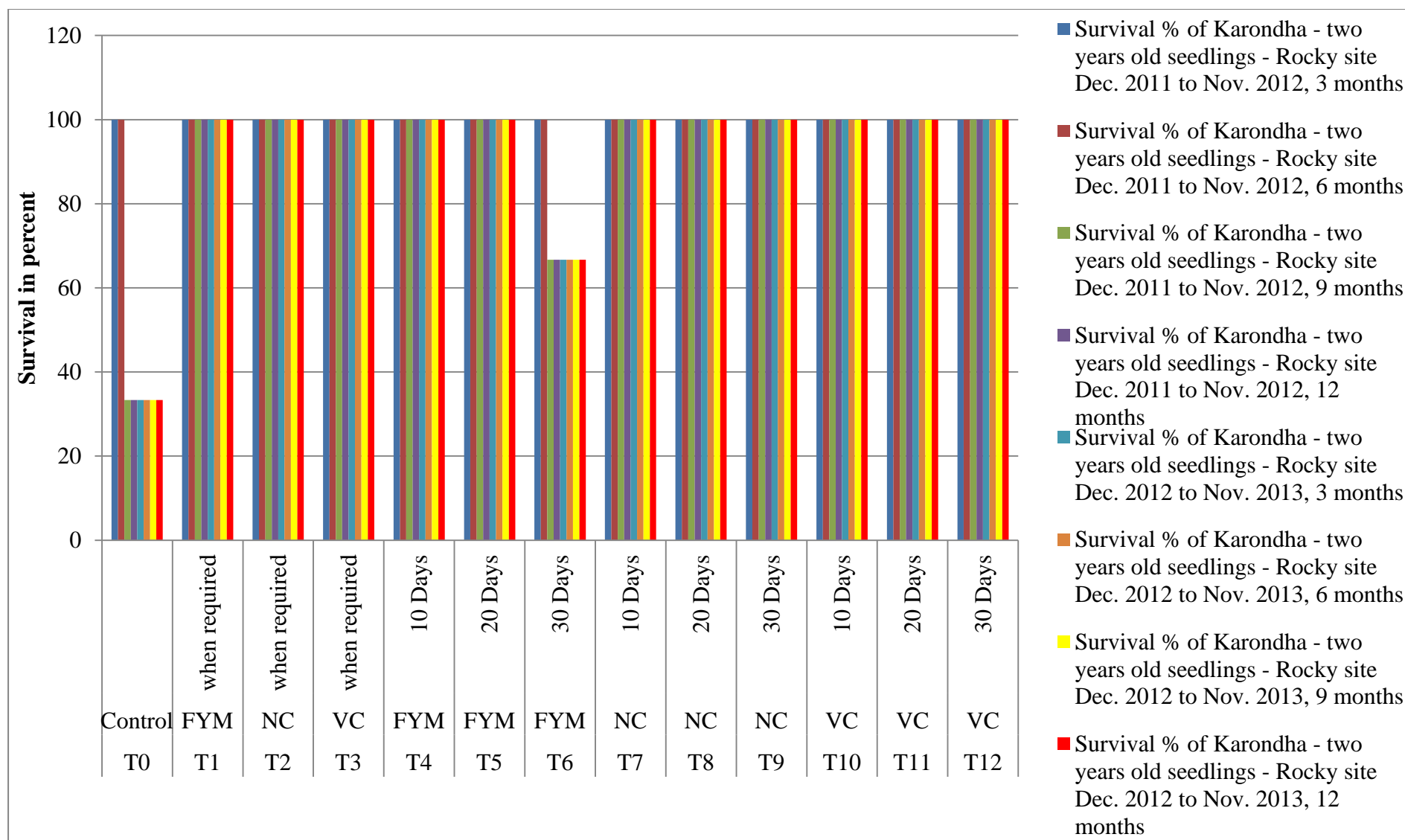


Fig. 4.3.3. Survival percentage of two year old seedling of Karondha at Rocky sites in December, 2011 to November, 2013

4.4. Six month old seedling plantation of *Pongamia pinnata* (Karanj) at Rocky site:

4.4.1. Increase in plant height (cm) of *Pongamia pinnata* (Karanj) – 6 month old seedling at Rocky site in December, 2011 to November, 2012 and December, 2012 to November, 2013.

Plant height during first year (Table 4.4.1.) -

The result of plant height after 3 month (6.67cm) was observed maximum in the treatment T₁₀ and followed by T₃ (6.40cm), T₁₁ (6.40cm) and T₄ (5.67cm). However, minimum was recorded in T₀ (3.67cm).

Plant height after 6 month (12.67cm) was observed maximum in T₁₀ and followed by T₃ (11.00cm), T₁₁ (10.33cm) and T₄ (10.33cm). However, minimum was recorded in T₀ (4.92cm).

Plant height after 9 month (13.33cm) was observed maximum in T₁₀ and followed by T₃ (13.00cm), T₁₁ (12.67cm) and T₄ (12.33cm). However, minimum was recorded in T₀ (6.33cm).

Plant height after 12 month (16.00cm) was observed maximum in T₁₀ and followed by T₃ (14.33cm), T₁₁ (14.17cm) and T₄ (13.33cm). However, minimum was recorded in T₀ (10.33cm). Other organic manure and irrigation schedule showed the significant differences in the plant height in all monthly treatment of first year.

Plant height during second year (Table 4.4.1.) -

The result of the average plant height after 3 month (7.00cm) was observed maximum in the treatment T₁₀ and followed by T₁₁ (6.67cm) T₃ (6.67cm) and T₄ (6.33cm). However, minimum was recorded in T₀ (4.67cm).

Plant height after 6 month (11.63cm) was observed maximum in T₁₀ and followed by T₃ (10.63cm), T₁₁ (10.33cm) and T₁ (10.00cm). However, minimum was recorded in T₀ (5.10cm).

Plant height after 9 month (22.80cm) was observed maximum in T₁₀ and followed by T₃ (20.90cm), T₁₁ (20.33cm) and T₄ (18.97cm). However, minimum was recorded in T₀ (14.00cm).

Plant height after 12 month (27.00cm) was observed maximum in T₁₀ and followed by T₃ (24.70cm), T₁₁ (24.33cm) and T₄ (22.67cm). However, minimum was recorded in T₀ (13.33cm). Other organic manure and irrigation schedule showed the significant differences in the plant height in all treatment of second year.

Table 4.4.1. Increase in plant height (cm) of six months old seedlings of Karanj (*Pongamia pinnata*) at Rocky site at different intervals (Year-wise)

Treatment No.	Treatment		Increase in plant height (cm) of Karanj - 6 months old seedlings - Rocky site									
	Organic manure	Irrigation schedule	December, 2011 to November, 2012					December, 2012 to November, 2013				
			3 months	6 months	9 months	12 months	Total	3 months	6 months	9 months	12 months	Total
T ₀	Control		3.67	4.92	6.33	10.33	25.25	4.67	5.10	14.00	13.33	37.10
T ₁	FYM	When required	5.33	8.67	11.67	13.23	38.90	6.33	9.07	18.70	22.00	56.10
T ₂	NC	When required	5.33	7.00	11.33	12.57	36.23	5.67	8.23	17.67	19.67	51.24
T ₃	VC	When required	6.40	11.00	13.00	14.33	44.73	6.67	10.63	20.90	24.70	62.90
T ₄	FYM	10 Days	5.67	10.33	12.33	13.33	41.66	6.33	10.00	18.97	22.67	57.97
T ₅	FYM	20 Days	5.33	7.00	11.67	13.23	37.23	6.00	8.67	18.33	21.70	54.70
T ₆	FYM	30 Days	4.33	5.60	8.67	10.63	29.23	5.00	6.90	15.57	18.33	45.80
T ₇	NC	10 Days	5.33	6.67	10.33	12.37	34.70	5.67	8.00	16.40	19.67	49.74
T ₈	NC	20 Days	5.00	5.67	10.33	11.83	32.83	5.33	7.17	16.33	18.67	47.50
T ₉	NC	30 Days	3.82	5.17	6.33	10.33	25.65	4.67	5.10	14.00	13.33	37.10
T ₁₀	VC	10 Days	6.67	12.67	13.33	16.00	48.67	7.00	11.63	22.80	27.00	68.43
T ₁₁	VC	20 Days	6.33	10.33	12.67	14.17	43.50	6.67	10.33	20.33	24.33	61.66
T ₁₂	VC	30 Days	4.00	5.33	7.67	10.33	27.33	4.67	6.70	14.20	16.33	41.90
		F- test	S	S	S	S		S	S	S	S	
		S. Ed. (±)	0.84	1.22	1.75	2.56		1.12	1.75	3.77	4.22	
		C. D. (P = 0.05)	1.74	2.51	3.60	5.27		2.31	3.61	7.77	8.70	

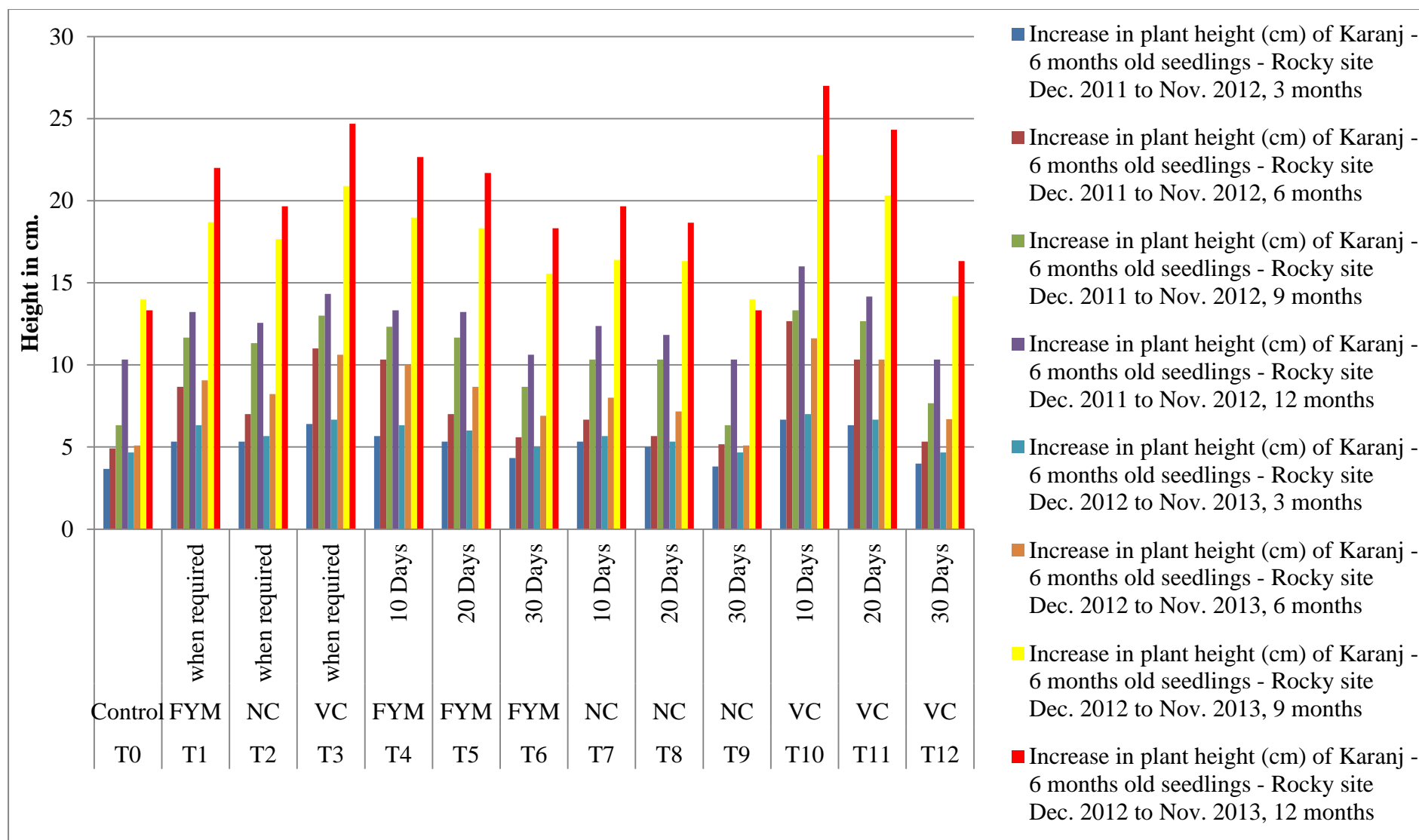


Fig.4.4.1. Increase in plant height (cm) of Karanj – 6 month old seedling at Rocky site in December, 2011 to November, 2013.

4.4.2. Increase in Collar diameter (cm) of *Pongamia pinnata* (Karanj) – 6 month old seedling at Rocky site in December, 2011 to November, 2012 and December, 2012 to November, 2013.

Plant Collar diameter during first year (Table 4.4.2.) -

The result of the average Collar diameter after 3 month (0.77cm) was observed maximum in the treatment T₁₀, and followed by T₃ (0.76cm), T₄ (0.68cm) and T₁₁ (0.67cm), However, minimum increase Collar diameter was recorded in T₀ (0.32cm).

Collar diameter after 6 month (0.75cm) was observed maximum in T₁₀ and followed by T₃ (0.67cm), T₁₁ (0.67cm) and T₄ (0.67cm). However, minimum increase Collar diameter was recorded in T₀ (0.17cm).

Collar diameter after 9 month (1.50cm) was observed maximum in T₁₀ and followed by T₃ (1.50cm), T₁₁ (1.42cm) and T₄ (1.33cm). However, minimum increase Collar diameter was recorded in T₀ (0.51cm).

Collar diameter after 12 month (1.50cm) was observed maximum in T₁₀ and followed by T₃ (1.42cm), T₁₁ (1.42cm) and T₄ (1.33cm). However, minimum increase Collar diameter was recorded in T₀ (0.52cm). Other organic manure and irrigation schedule showed the significant differences in the plant collar diameter in all treatment of first year.

Plant Collar diameter during second year (Table 4.4.2.) -

The result of the average Collar diameter after 3 month increase Collar diameter (0.65cm) was observed maximum in the treatment T₁₀ and followed by T₃ (0.62cm), T₁₁ (0.62cm) and T₄ (0.62 cm), However, minimum increase Collar diameter was recorded in T₀ (0.31cm).

Collar diameter after 6 month (1.53cm) was observed maximum in T₁₀ and followed by T₃ (1.38cm), T₁₁ (1.30cm) and T₄ (1.26cm). However, minimum increase Collar diameter was recorded in T₀ (0.66cm).

Collar diameter after 9 month (1.55cm) was observed maximum in T₁₀ and followed by T₃ (1.55cm), T₁₁ (1.49cm) and T₄ (1.46cm). However, minimum increase Collar diameter was recorded in T₀ (0.92cm).

Collar diameter after 12 month (2.54cm) was observed maximum in T₁₀ and followed by T₃ (2.24cm), T₁₁ (2.32cm) and T₄ (2.12cm). However, minimum increase Collar diameter was recorded in T₀ (1.57cm). Other organic manure and irrigation schedule showed the significant differences in the plant collar diameter in all monthly treatment of second year.

Table 4.4.2. Increase in collar diameter (cm) of six months old seedlings of Karanj (*Pongamia pinnata*) at Rocky site at different intervals (Year-wise)

Treatment No.	Treatment		Increase in collar diameter (cm) of Karanj - 6 months old seedlings - Rocky site									
			December, 2011 to November, 2012					December, 2012 to November, 2013				
	Organic manure	Irrigation schedule	3 months	6 months	9 months	12 months	Total	3 months	6 months	9 months	12 months	Total
T ₀	Control		0.32	0.17	0.51	0.52	1.52	0.31	0.66	0.92	1.57	3.46
T ₁	FYM	When required	0.60	0.58	1.08	1.13	3.39	0.61	1.06	1.43	2.15	5.25
T ₂	NC	When required	0.59	0.53	0.92	1.00	3.04	0.53	0.97	1.40	2.10	5.00
T ₃	VC	When required	0.76	0.67	1.50	1.42	4.35	0.62	1.38	1.55	2.24	5.79
T ₄	FYM	10 Days	0.68	0.67	1.33	1.33	4.01	0.62	1.26	1.46	2.12	5.46
T ₅	FYM	20 Days	0.61	0.55	0.92	1.05	3.13	0.53	1.02	1.43	2.17	5.15
T ₆	FYM	30 Days	0.50	0.40	0.52	0.42	1.84	0.40	0.86	1.05	1.50	3.81
T ₇	NC	10 Days	0.59	0.46	0.83	0.83	2.71	0.45	0.95	1.35	2.11	4.86
T ₈	NC	20 Days	0.51	0.43	0.75	0.75	2.44	0.42	0.87	1.35	2.18	4.82
T ₉	NC	30 Days	0.35	0.17	0.51	0.52	1.55	0.31	0.66	0.92	1.57	3.46
T ₁₀	VC	10 Days	0.77	0.75	1.50	1.50	4.52	0.65	1.53	1.55	2.54	6.27
T ₁₁	VC	20 Days	0.67	0.67	1.42	1.42	4.18	0.62	1.30	1.49	2.32	5.73
T ₁₂	VC	30 Days	0.39	0.32	0.56	0.42	1.69	0.32	0.85	1.10	1.50	3.77
		F- test	S	S	S	S		S	S	S	S	
		S. Ed. (\pm)	0.14	0.11	0.27	0.21		0.13	0.18	0.19	0.52	
		C. D. (P = 0.05)	0.28	0.22	0.57	0.43		0.26	0.37	0.40	1.07	

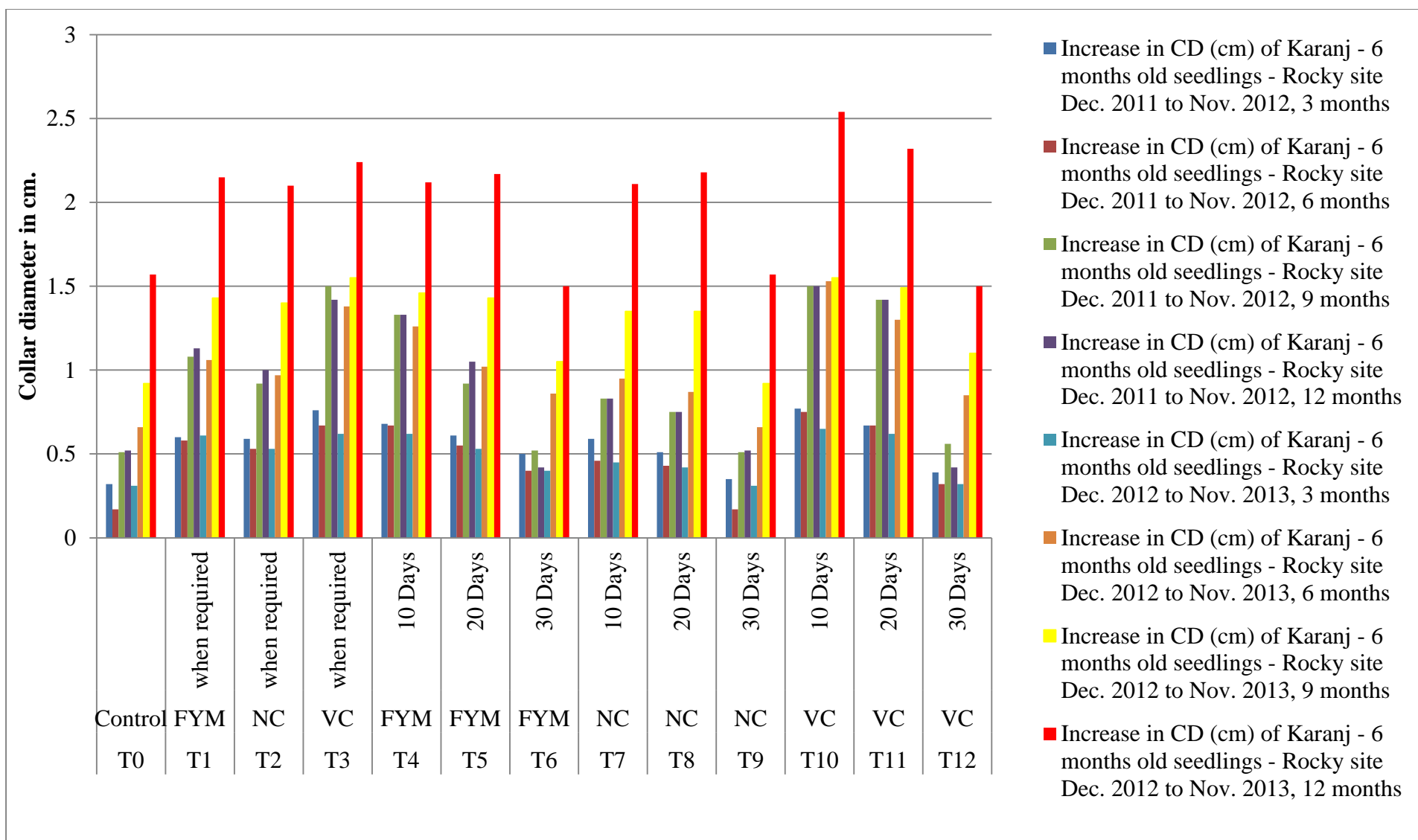


Fig. 4.4.2. Increase in Collar diameter (cm) of Karanj – 6 month old seedling at Rocky sites in December, 2011 to November, 2013.

4.4.3. Survival percentage of *Pongamia pinnata* (Karanj) - 6 months old seedling at Rocky site at different intervals in December, 2011 to November, 2012 and December, 2012 to November, 2013.

Plant Survival percentage during first year (Table 4.4.3.) -

The survivality in first year of 3 month reported Karanj seedlings grown at Rocky sites with different intervals of irrigation schedule along with the applications of organic manures available or provide in a form of different treatment combinations.

The study clearly indicates non significant maximum survival percentage i.e. 100% was found in T₁, T₂, T₃, T₄ T₅, T₇, T₈, T₁₀, T₁₁ and T₁₂ due to good soil condition, nature of soil fertility availability essential minerals & nutrients, proper and good health condition of Karanj seedlings and its adaptability. This followed T₀, T₆ and T₉, with 66.67% which shows minimum survival percentage of Karanj seedlings.

The result of 6, 9, 12 month indicates significant maximum survival percentage i.e. 100% was found in T₁, T₂, T₃, T₄ T₅, T₇, T₈, T₁₀, T₁₁ and T₁₂ due to good soil condition, nature of soil fertility availability essential minerals & nutrients, proper and good health condition of Karanj seedlings and its adaptability. This followed T₆, T₉, T₁₂ with 66.67 % and treatment T₀ (control) which shows (33.33%) minimum survival percentage of Karanj seedlings because of some deficiencies are found present in rocky site or decrease in physical nature of soil. Overall it is observed that treatment T₁₀ (vermicompost @ 10 days of irrigation schedule) with maximum survivality or survival % i.e. 100@ along with other attributes or observatory parameters would consider the best treatment combination.

Plant Survival percentage during second year (Table 4.4.3.) -

The survivality in second year of 3, 6, 9 and 12 month reported Karanj seedlings grown at Rocky sites with different intervals of irrigation schedule along with the applications of organic manures available or provide in a form of different treatment combinations.

The study clearly indicates significant maximum survival percentage i.e. 100% was found in T₁, T₂, T₃, T₄ T₅, T₇, T₈, T₁₀, and T₁₁ due to good soil condition, nature of soil fertility availability essential minerals & nutrients, proper and good health

condition of Karanj seedlings and its adaptability. This followed T₆, T₉, T₁₂ with 66.67 % and treatment T₀ (control) which shows (33.33%) minimum survival percentage of Karanj seedlings because of some deficiencies are found present in rocky site or decrease in physical nature of soil. Overall it is observed that treatment T₁₀ (vermicompost @ 10 days of irrigation schedule) with maximum survivality or survival % i.e. 100@ along with other attributes or observatory parameters would consider the best treatment combination.

Table 4.4.3. Survival percentage of six months old seedlings of Karanj (*Pongamia pinnata*) at Rocky site at different intervals (Year-wise)

Treatment No.	Treatment		Survival percentage of Karanj - 6 months old seedlings - Rocky site									
			December, 2011 to November, 2012					December, 2012 to November, 2013				
			3 months	6 months	9 months	12 months	Total	3 months	6 months	9 months	12 months	Total
T ₀	Control		66.67	33.33	33.33	33.33	33.33	33.33	33.33	33.33	33.33	33.33
T ₁	FYM	When required	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₂	NC	When required	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₃	VC	When required	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₄	FYM	10 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₅	FYM	20 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₆	FYM	30 Days	66.67	66.67	66.67	66.67	66.67	66.67	66.67	66.67	66.67	66.67
T ₇	NC	10 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₈	NC	20 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₉	NC	30 Days	66.67	66.67	66.67	66.67	66.67	66.67	66.67	66.67	66.67	66.67
T ₁₀	VC	10 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₁₁	VC	20 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₁₂	VC	30 Days	100.00	66.67	66.67	66.67	66.67	66.67	66.67	66.67	66.67	66.67
		F- test	NS	NS	NS	NS		NS	NS	NS	NS	
		S. Ed. (\pm)	-	-	-	-		-	-	-	-	
		C. D. (P = 0.05)	-	-	-	-		-	-	-	-	

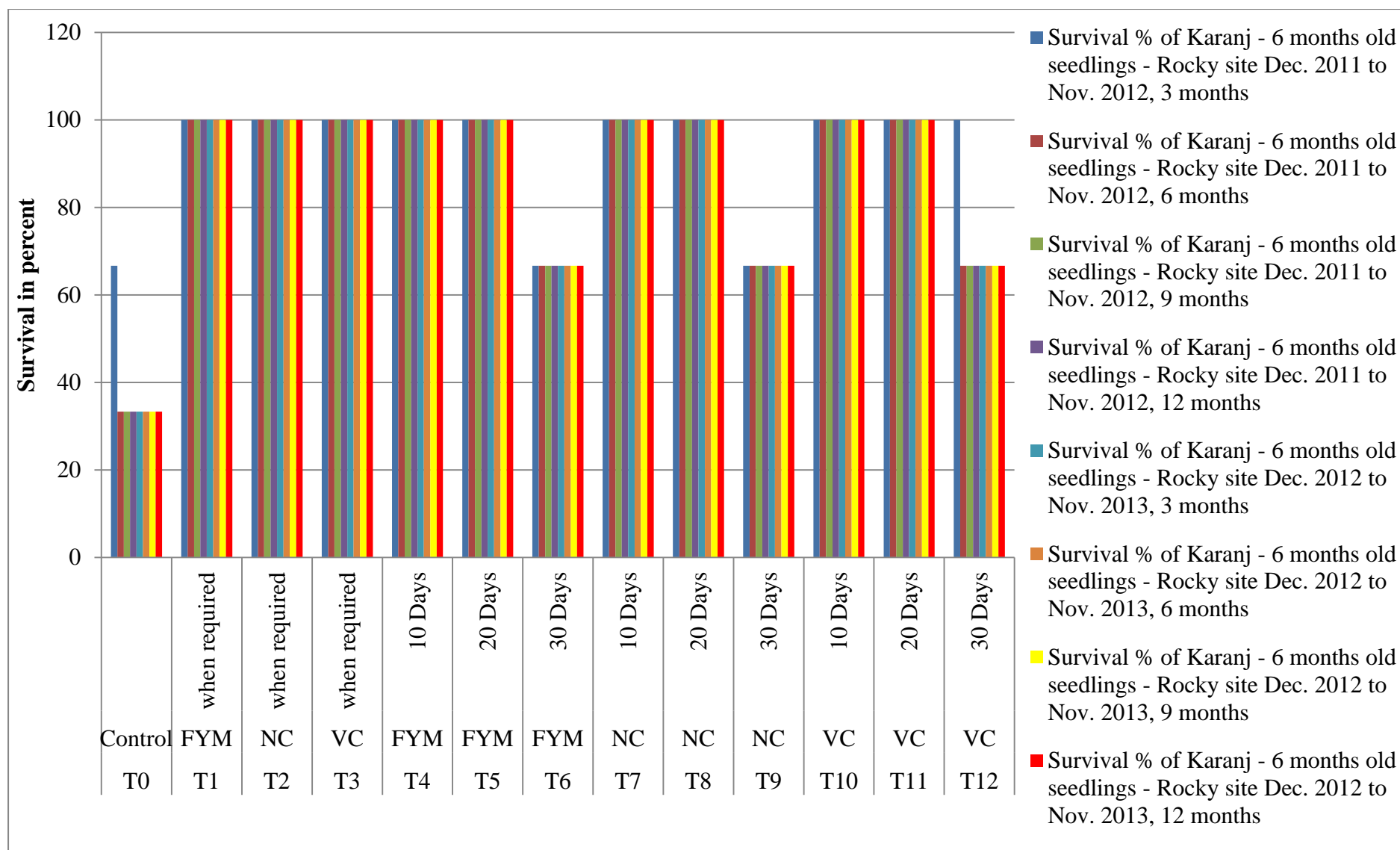


Fig. 4.4.3. Survival percentage of Karanj 6 month old seedling at Rocky sites in December, 2011 to November, 2013.

4.5. One year old seedling plantation of *Pongamia pinnata* (Karanj) at Rocky site:

4.5.1. Increase in plant height (cm) of one year old seedling of *Pongamia pinnata* (Karanj) at Rocky site in December, 2011 to November, 2012 and December, 2012 to November, 2013.

Plant height during first year (Table 4.5.1.) -

The result of the average plant height after 3 month (10.67cm) was observed maximum in the treatment T₁₀ and followed by T₃ (8.33cm), T₁₁ (6.70cm) and T₄ (6.67cm). However, minimum was recorded in T₀ (3.67cm).

Plant height after 6 month (13.33cm) was observed maximum in T₁₀ and followed by T₃ (12.67cm), T₁₁ (12.67cm) and T₄ (12.33cm). However, minimum was recorded in T₀ (4.33cm).

Plant height after 9 month (22.00cm) was observed maximum in T₁₀ and followed by T₃ (20.33cm), T₁₁ (20.33cm) and T₄ (18.67cm). However, minimum was recorded in T₀ (10.00cm).

Plant height after 12 month (32.67cm) was observed maximum in T₁₀ and followed by T₃ (31.33cm), T₁₁ (31.00cm) and T₄ (30.67cm). However, minimum was recorded in T₀ (11.33cm). Other organic manure and irrigation schedule showed the significant differences in the plant height in all monthly treatment of first year.

Plant Survival percentage during first year (Table 4.5.1.) -

The result of the average plant height after 3 month (13.33cm) was observed maximum in the treatment T₁₀ and followed by T₃ (11.33cm), T₁₁ (11.00cm) and T₄ (10.33cm). However, minimum was recorded in T₀ (4.00cm).

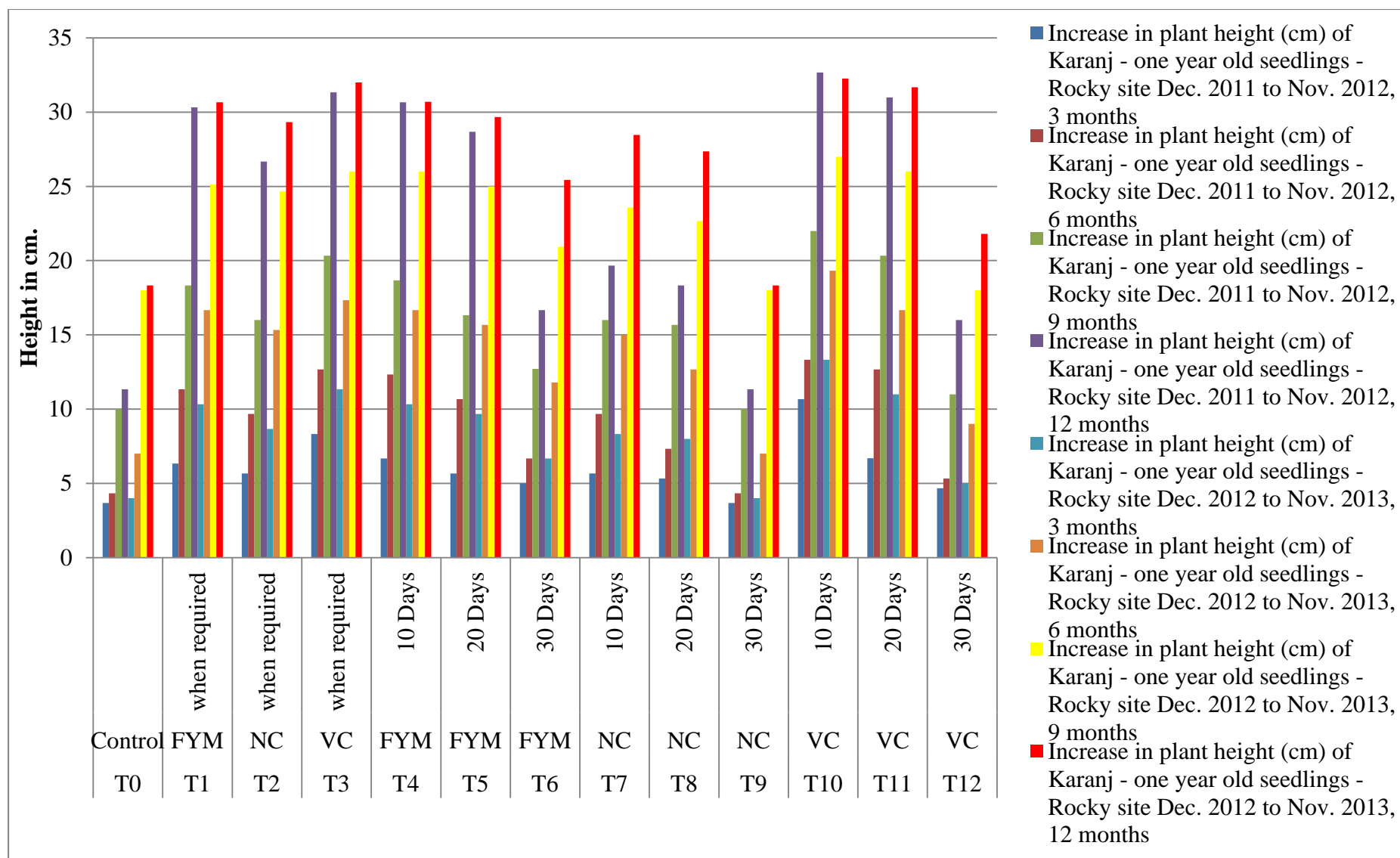
Plant height after 6 month (19.33cm) was observed maximum in T₁₀ and followed by T₃ (17.33cm), T₁₁ (16.67cm) and T₄ (16.67cm). However, minimum was recorded in T₀ (7.00cm).

Plant height after 9 month (27.00cm) was observed maximum in T₁₀ and followed by T₃ (26.00cm), T₁₁ (26.00 cm) and T₄ (26.00cm). However, minimum was recorded in T₀ (18.00cm).

Plant height after 12 month (32.27cm) was observed maximum in T₁₀ and followed by T₃ (32.00cm), T₁₁ (31.67cm) and T₄ (30.70cm). However, minimum was recorded in T₀ (18.33cm). Other organic manure and irrigation schedule showed the significant differences in the plant height in all monthly treatment of second year.

Table 4.5.1. Increase in plant height (cm) of one year old seedlings of Karanj (*Pongamia pinnata*) at Rocky site at different intervals (Year-wise)

Treatment No.	Treatment		Increase in plant height (cm) of Karanj - one year old seedlings - Rocky site									
	Organic manure	Irrigation schedule	December, 2011 to November, 2012					December, 2012 to November, 2013				
			3 months	6 months	9 months	12 months	Total	3 months	6 months	9 months	12 months	Total
T ₀	Control		3.67	4.33	10.00	11.33	29.33	4.00	7.00	18.00	18.33	47.33
T ₁	FYM	When required	6.33	11.33	18.33	30.33	66.32	10.33	16.67	25.13	30.67	82.80
T ₂	NC	When required	5.67	9.67	16.00	26.67	58.01	8.67	15.33	24.67	29.33	78.00
T ₃	VC	When required	8.33	12.67	20.33	31.33	72.66	11.33	17.33	26.00	32.00	86.66
T ₄	FYM	10 Days	6.67	12.33	18.67	30.67	68.34	10.33	16.67	26.00	30.70	83.70
T ₅	FYM	20 Days	5.67	10.67	16.33	28.67	61.34	9.67	15.67	25.00	29.67	80.01
T ₆	FYM	30 Days	5.00	6.67	12.70	16.67	41.04	6.67	11.80	20.93	25.43	64.83
T ₇	NC	10 Days	5.67	9.67	16.00	19.67	51.01	8.33	15.00	23.57	28.47	75.37
T ₈	NC	20 Days	5.33	7.33	15.67	18.33	46.66	8.00	12.67	22.67	27.35	70.69
T ₉	NC	30 Days	3.67	4.33	10.00	11.33	29.33	4.00	7.00	18.00	18.33	47.33
T ₁₀	VC	10 Days	10.67	13.33	22.00	32.67	78.67	13.33	19.33	27.00	32.27	91.93
T ₁₁	VC	20 Days	6.70	12.67	20.33	31.00	70.70	11.00	16.67	26.00	31.67	85.34
T ₁₂	VC	30 Days	4.67	5.33	11.00	16.00	37.00	5.00	9.00	18.00	21.80	53.80
		F- test	S	S	S	S		S	S	S	S	
		S. Ed. (\pm)	0.16	0.58	1.58	1.65		0.72	1.92	4.20	4.62	
		C. D. (P = 0.05)	0.34	1.21	3.25	3.41		1.48	3.96	8.67	9.53	



4.5.1. Increase in plant height (cm) of one year old seedling of Karanj at Rocky sites in December, 2011 to November, 2013.

4.5.2. Increase in Collar diameter (cm) of one year old seedling of *Pongamia pinnata* (Karanj) at Rocky site in December, 2011 to November, 2012 and December, 2012 to November, 2013.

Plant Collar diameter during first year (Table 4.5.2.) -

The result of the average Collar diameter after 3 month (0.75cm) was observed maximum in the treatment T_{10} and followed by T_3 (0.74cm), T_{11} (0.72cm) and T_4 (0.67cm), However, minimum increase Collar diameter was recorded in T_0 (0.41cm).

Collar diameter after 6 month (1.50cm) was observed maximum in T_{10} and followed by T_3 (0.83cm), T_{11} (0.75cm) and T_4 (0.64cm). However, minimum increase Collar diameter was recorded in T_0 (0.22cm).

Collar diameter after 9 month (2.33cm) was observed maximum in T_{10} and followed by T_3 (1.83cm), T_{11} (1.83cm) and T_4 (1.45cm). However, minimum increase Collar diameter was recorded in T_0 (0.78cm).

Collar diameter after 12 month increase Collar diameter (2.33cm) was observed maximum in T_{10} and followed by T_3 (1.89cm), T_{11} (1.67cm) and T_4 (1.58cm). However, minimum increase Collar diameter was recorded in T_0 (0.84cm). Other organic manure and irrigation schedule showed the significant differences in the plant collar diameter in all monthly treatment of first year.

Plant Collar diameter during second year (Table 4.5.2.) -

The result of the average Collar diameter after 3 month (0.62cm) was observed maximum in the treatment T_{10} and followed by T_3 (0.60cm), T_{11} (0.50cm) and T_4 (0.50cm), However, minimum increase Collar diameter was recorded in T_0 (0.21cm).

Collar diameter after 6 month (1.88cm) was observed maximum in T_{10} and followed by T_3 (1.86cm), T_{11} (1.68cm) and T_4 (1.64cm). However, minimum increase Collar diameter was recorded in T_0 (0.81cm).

Collar diameter after 9 month (2.22cm) was observed maximum in T_{10} and followed by T_3 (2.02cm), T_{11} (1.92cm) and T_4 (1.86cm). However, minimum increase Collar diameter was recorded in T_0 (1.23cm).

Collar diameter after 12 month (2.20cm) was observed maximum in T₇ and followed by T₁ (2.05cm), T₂ (1.99cm) and T₅ (1.98cm). However, minimum increase Collar diameter was recorded in T₀ (1.08cm). Other organic manure and irrigation schedule showed the significant differences in the plant collar diameter in all monthly treatment of second year.

Table 4.5.2. Increase in collar diameter (cm) of one year old seedlings of Karanj (*Pongamia pinnata*) at Rocky site at different intervals (Year-wise)

Treatment No.	Treatment		Increase in collar diameter (cm) of Karanj - one year old seedlings - Rocky site									
			December, 2011 to November, 2012					December, 2012 to November, 2013				
	Organic manure	Irrigation schedule	3 months	6 months	9 months	12 months	Total	3 months	6 months	9 months	12 months	Total
T ₀	Control		0.41	0.22	0.78	0.84	2.25	0.21	0.81	1.23	1.25	3.50
T ₁	FYM	When required	0.63	0.53	1.25	1.56	3.97	0.50	1.64	1.81	2.05	6.00
T ₂	NC	When required	0.58	0.50	1.22	1.42	3.72	0.42	1.32	1.77	1.99	5.50
T ₃	VC	When required	0.74	0.83	1.83	1.89	5.29	0.60	1.86	2.02	1.58	6.06
T ₄	FYM	10 Days	0.67	0.64	1.45	1.58	4.34	0.50	1.64	1.86	1.95	5.95
T ₅	FYM	20 Days	0.62	0.50	1.25	1.56	3.93	0.42	1.38	1.78	1.98	5.56
T ₆	FYM	30 Days	0.56	0.33	0.89	1.00	2.78	0.33	0.87	1.52	1.22	3.94
T ₇	NC	10 Days	0.58	0.50	1.00	1.08	3.16	0.40	1.13	1.76	2.20	5.49
T ₈	NC	20 Days	0.58	0.43	1.00	1.00	3.01	0.33	0.88	1.72	1.22	4.15
T ₉	NC	30 Days	0.47	0.22	0.78	0.85	2.32	0.22	0.81	1.23	1.27	3.54
T ₁₀	VC	10 Days	0.75	1.50	2.33	2.33	6.91	0.62	1.88	2.22	1.08	5.80
T ₁₁	VC	20 Days	0.72	0.75	1.83	1.67	4.97	0.50	1.68	1.92	1.57	5.66
T ₁₂	VC	30 Days	0.42	0.32	0.85	0.92	2.51	0.21	0.83	1.51	1.25	3.80
		F- test	S	S	S	S		S	S	S	S	
		S. Ed. (±)	0.04	0.16	0.35	0.19		0.08	0.19	0.37	0.53	
		C. D. (P = 0.05)	0.09	0.32	0.71	0.40		0.16	0.39	0.75	1.10	

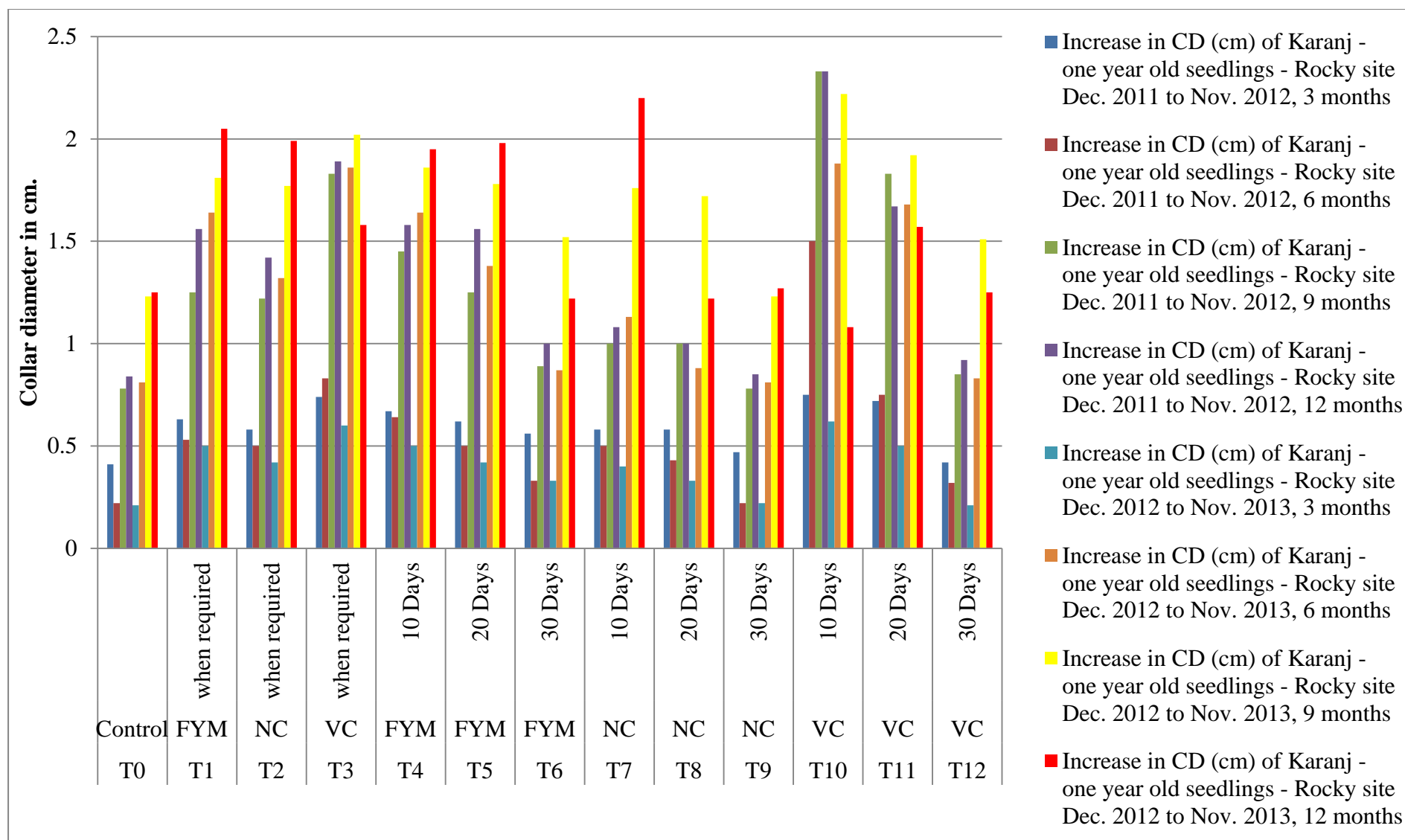


Fig. 4.5.2. Increase in Collar diameter (cm) of one year old seedling of Karanj at Rocky site in December, 2011 to November, 2013.

4.5.3. Survival percentage of one year old seedling of *Pongamia pinnata* (Karanj) at Rocky site at different intervals December, 2011 to November, 2012 and December, 2012 to November, 2013.

The Survival percentage during first year (Table 4.5.3.) -

The survivality in first year of 3 month reported Karanj seedlings grown at Rocky sites with different intervals of irrigation schedule along with the applications of organic manures available or provide in a form of different treatment combinations.

The study clearly indicates non significant maximum survival percentage i.e. 100% was found in T₁, T₁, T₂, T₃, T₄ T₅, T₆, T₇, T₈, T₉, T₁₀, T₁₁ and T₁₂ .

The survivality in first year of 6, 9 and 12 month reported Karanj seedlings grown at Rocky sites with different intervals of irrigation schedule along with the applications of organic manures available or provide in a form of different treatment combinations.

The result indicates non significant maximum survival percentage i.e. 100% was found in T₁, T₂, T₃, T₄ T₅, T₆, T₇, T₈, T₁₀ T₁₁, and T₁₂ due to good soil condition, nature of soil fertility availability essential minerals & nutrients, proper and good health condition of Karanj seedlings and its adaptability. This followed T₀ and T₉ with 66.67% which shows minimum survival percentage of Karanj seedlings because of some deficiencies are found present in rocky site with decrease physical properties of soil. Overall it is observed that treatment T₁₀ (vermicompost @ 10 days of irrigation schedule) with maximum survivality or survival % i.e. 100@ along with other attributes or observatory parameters would consider the best treatment combination.

The Survival percentage during second year (Table 4.5.3.) -

The survivality in second year of 3 month reported Karanj seedlings grown at Rocky sites with different intervals of irrigation schedule along with the applications of organic manures available or provide in a form of different treatment combinations.

The study clearly indicates non significant maximum survival percentage i.e. 100% was found in T₁, T₂, T₃, T₄ T₅, T₆, T₇, T₈, T₁₀, T₁₁ and T₁₂ treatments.

The result of 6, 9 and 12 month reported Karanj seedlings grown at Rocky sites with different intervals of irrigation schedule along with the applications of organic manures available or provide in a form of different treatment combinations.

The study clearly indicates significant maximum survival percentage i.e. 100% was found in T₁, T₂, T₃, T₄ T₅, T₆, T₇, T₈, T₁₀ and T₁₁ due to good soil condition, nature of soil fertility availability essential minerals & nutrients, proper and good health condition of Karanj seedlings and its adaptability. This followed T₉ and T₁₂ with 66.67% and treatment T₀ (control) which shows (33.33%) minimum survival percentage of Karanj seedlings because of some deficiencies are found present in rocky site or decrease in physical nature of soil. Overall it is observed that treatment T₁₀ (vermicompost @ 10 days of irrigation schedule) with maximum survivality or survival % i.e. 100@ along with other attributes or observatory parameters would consider the best.

Table 4.5.3. Survival percentage of one year old seedlings of *Pongamia pinnata* (Karanj) at Rocky site at different intervals (Year-wise)

Treatment No.	Treatment		Survival percentage of Aonla - one year old seedlings - Rocky site									
			December, 2011 to November, 2012					December, 2012 to November, 2013				
			3 months	6 months	9 months	12 months	Total	3 months	6 months	9 months	12 months	Total
T ₀	Control		100.00	66.67	66.67	66.67	66.67	66.67	33.33	33.33	33.33	33.33
T ₁	FYM	When required	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₂	NC	When required	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₃	VC	When required	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₄	FYM	10 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₅	FYM	20 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₆	FYM	30 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₇	NC	10 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₈	NC	20 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₉	NC	30 Days	100.00	66.67	66.67	66.67	66.67	66.67	66.67	66.67	66.67	66.67
T ₁₀	VC	10 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₁₁	VC	20 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₁₂	VC	30 Days	100.00	100.00	100.00	100.00	100.00	100.00	67.67	67.67	67.67	66.67
		F- test	NS	NS	NS	NS		NS	NS	NS	NS	
		S. Ed. (\pm)	-	-	-	-		-	-	-	-	
		C. D. (P = 0.05)	-	-	-	-		-	-	-	-	

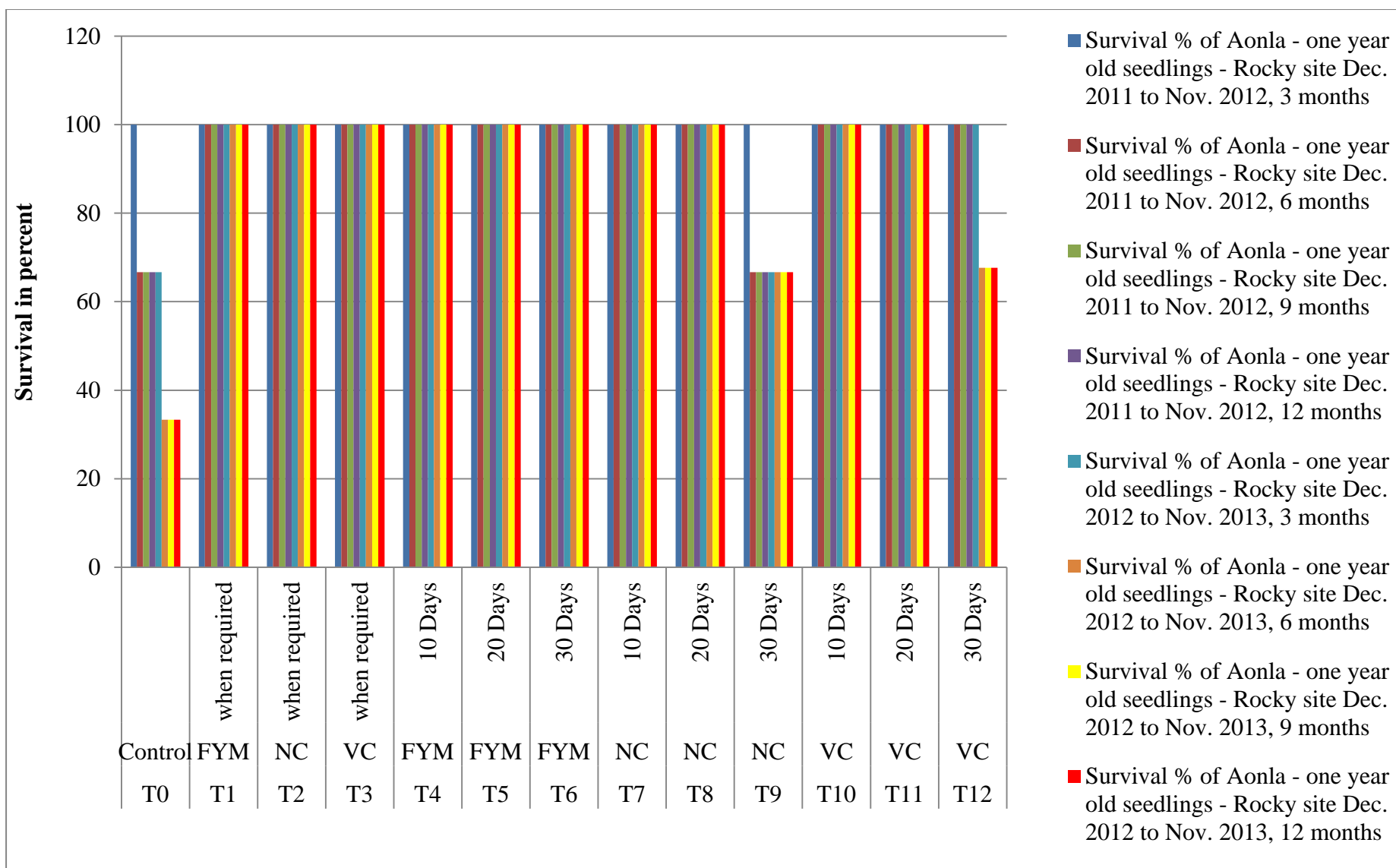


Fig. 4.5.3. Survival percentage of one year old seedling of Karanj at Rocky site in December, 2011 to November, 2013.

4.6. Two year old seedling plantation of *Pongamia pinnata* (Karanj) at Rocky site:

4.6.1. Increase in plant height (cm) of two year old seedling of *Pongamia pinnata* (Karanj) at Rocky site in December, 2011 to November, 2012 and December, 2012 to November, 2013.

The Plant height during first year (Table 4.6.1.) -

The result of the average plant height after 3 month (10.00cm) was observed maximum in the treatment T₁₀ and followed by T₃ (8.67cm), T₁₁ (8.67cm) and T₄ (8.00cm), However, minimum was recorded in T₀ (3.67cm).

Plant height after 6 month (13.67cm) was observed maximum in T₁₀ and followed by T₃ (13.00cm), T₁₁ (12.67cm) and T₄ (12.00cm). However, minimum was recorded in T₀ (5.60cm).

Plant height after 9 month (28.00cm) was observed maximum in T₁₀ and followed by T₃ (25.33cm), T₁₁ (25.13cm) and T₄ (24.33cm). However, minimum was recorded in T₀ (14.33cm).

Plant height after 12 month (36.33cm) was observed maximum in T₁₀ and followed by T₃ (35.66cm), T₁₁ (34.67cm) and T₄ (32.67cm). However, minimum was recorded in T₀ (16.33cm). Other organic manure and irrigation schedule showed the significant differences in the plant height in all monthly treatment of first year.

The Plant height during second year (Table 4.6.1.) -

The result of the average plant height after 3 month (12.67cm) was observed maximum in the treatment T₁₀ and followed by T₃ (12.33cm), T₁₁ (12.33cm) and T₄ (12.00cm), However, minimum was recorded in T₀ (3.33cm).

Plant height after 6 month (15.67cm) was observed maximum in T₁₀ and followed by T₃ (13.37cm), T₁₁ (15.43cm) and T₄ (8.37cm). However, minimum was recorded in T₀ (6.67cm).

Plant height after 9 month (37.00cm) was observed maximum in T₁₀ and followed by T₃ (36.00cm), T₁₁ (36.00cm) and T₄ (36.00cm). However, minimum was recorded in T₀ (27.67cm).

Plant height after 12 month (40.33cm) was observed maximum in T₁₀ and followed by T₃ (40.33cm), T₁₁ (39.67cm) and T₄ (39.33cm). However, minimum was recorded in T₀ (26.87cm). Other organic manure and irrigation schedule showed the significant differences in the plant height in all monthly treatment of second year.

Table 4.6.1. Increase in plant height (cm) of two years old seedlings of Karanj (*Pongamia pinnata*) at Rocky site at different intervals (Year-wise)

Treatment No.	Treatment		Increase in plant height (cm) of Karanj - two years old seedlings - Rocky site									
	Organic manure	Irrigation schedule	December, 2011 to November, 2012					December, 2012 to November, 2013				
			3 months	6 months	9 months	12 months	Total	3 months	6 months	9 months	12 months	Total
T ₀	Control		3.67	5.60	14.33	16.33	39.93	3.33	6.67	27.67	26.87	64.54
T ₁	FYM	When required	7.67	11.33	20.33	31.67	71.00	11.00	10.60	34.00	38.33	93.93
T ₂	NC	When required	7.33	9.33	19.33	29.67	65.66	8.00	10.53	31.70	38.00	88.23
T ₃	VC	When required	8.67	13.00	25.33	35.66	82.66	12.33	13.37	36.00	40.33	102.03
T ₄	FYM	10 Days	8.00	12.00	24.33	32.67	77.00	12.00	8.37	36.00	39.33	95.70
T ₅	FYM	20 Days	7.67	11.00	20.33	31.33	70.33	10.33	11.10	32.00	38.33	91.76
T ₆	FYM	30 Days	6.67	6.67	16.33	20.33	50.00	5.00	11.20	30.37	33.88	80.45
T ₇	NC	10 Days	7.33	8.00	18.67	28.13	62.13	5.67	13.03	31.33	35.70	85.73
T ₈	NC	20 Days	7.00	7.67	17.00	27.33	59.00	5.00	11.77	31.00	34.67	82.44
T ₉	NC	30 Days	3.67	5.67	14.33	16.33	40.00	3.33	6.67	27.67	26.87	64.54
T ₁₀	VC	10 Days	10.00	13.67	28.00	36.33	88.00	12.67	15.67	37.00	40.33	105.67
T ₁₁	VC	20 Days	8.67	12.67	25.13	34.67	81.14	12.33	15.43	36.00	39.67	103.43
T ₁₂	VC	30 Days	6.00	6.33	15.33	17.00	44.66	4.00	10.10	28.07	30.00	72.17
		F- test	S	S	S	S		S	S	S	S	
		S. Ed. (±)	0.22	0.75	1.88	2.12		0.38	1.42	5.30	5.25	
		C. D. (P = 0.05)	0.45	1.55	3.89	4.37		0.78	2.93	10.95	10.83	

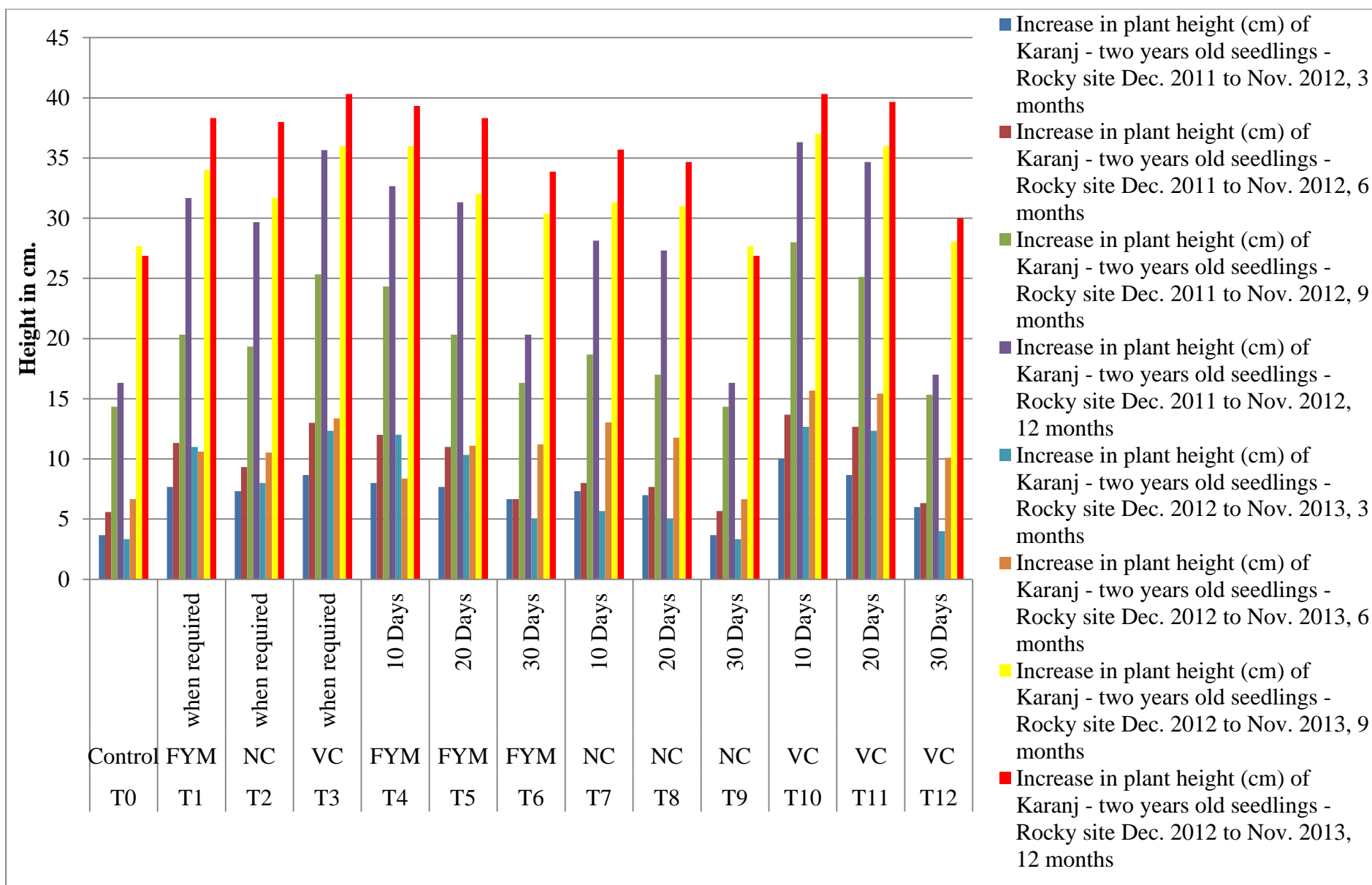


Fig. 4.6.1. Increase in plant height (cm) of two year old seedling of Karanj at Rocky site in December, 2011 to November, 2013.

4.6.2. Increase in Collar diameter (cm) of two year old seedling of *Pongamia pinnata* (Karanj) at Rocky site in December, 2011 to November, 2012 and December, 2012 to November, 2013.

The Plant Collar diameter during first year (Table 4.6.2.) -

The result of average Collar diameter after 3 month (1.22cm) was observed maximum in the treatment T₁₀ and followed by T₃ (1.08cm), T₁₁ (1.00cm) and T₄ (0.95cm), However, minimum increase Collar diameter was recorded in T₀ (0.57cm).

Collar diameter after 6 month (2.17cm) was observed maximum in T₁₀ and followed by T₃ (1.83cm), T₁₁ (1.67cm) and T₄ (1.67cm). However, minimum increase Collar diameter was recorded in T₀ (0.67cm).

Collar diameter after 9 month (2.83cm) was observed maximum in T₁₀ and followed by T₃ (2.67cm), T₁₁ (2.33cm) and T₄ (2.33cm). However, minimum increase Collar diameter was recorded in T₀ (1.58cm).

Collar diameter after 12 month (2.83cm) was observed maximum in T₁₀ and followed by T₃ (2.83cm), T₁₁ (2.75cm) and T₄ (2.69cm). However, minimum increase Collar diameter was recorded in T₀ (1.50cm). Other organic manure and irrigation schedule showed the significant differences in the plant collar diameter in all monthly treatment of first year.

The Plant Collar diameter during second year (Table 4.6.2.) -

The result of the average Collar diameter after 3 month (1.43cm) was observed maximum in the treatment T₁₀ and followed by T₃ (1.30cm), T₁₁ (1.27cm) and T₄ (1.13cm), However, minimum increase Collar diameter was recorded in T₀ (0.45cm).

Collar diameter after 6 month (2.15cm) was observed maximum in T₁₀ and followed by T₃ (2.05cm), T₁₁ (2.01cm) and T₄ (2.00cm). However, minimum increase Collar diameter was recorded in T₀ (1.26m).

Collar diameter after 9 month (2.76cm) was observed maximum in T₁₀ and followed by T₃ (2.75cm), T₁₁ (2.68cm) and T₄ (2.67cm). However, minimum increase Collar diameter was recorded in T₀ (1.67cm).

Collar diameter after 12 month (2.59cm) was observed maximum in T₁₀ and followed by T₃ (2.43cm), T₁₁ (2.42cm) and T₄ (2.42cm). However, minimum increase Collar diameter was recorded in T₀ (2.00cm). Other organic manure and irrigation schedule showed the significant differences in the plant collar diameter in all monthly treatment of second year.

Table 4.6.2. Increase in collar diameter (cm) of two years old seedlings of Karanj (*Pongamia pinnata*) at Rocky site at different intervals (Year-wise)

Treatment No.	Treatment		Increase in collar diameter (cm) of Karanj - two years old seedlings - Rocky site									
			December, 2011 to November, 2012					December, 2012 to November, 2013				
	Organic manure	Irrigation schedule	3 months	6 months	9 months	12 months	Total	3 months	6 months	9 months	12 months	Total
T ₀	Control		0.57	0.67	1.58	1.50	4.31	0.45	1.26	1.67	2.00	5.38
T ₁	FYM	When required	0.87	1.52	2.33	2.67	7.39	1.08	1.95	2.65	2.37	8.05
T ₂	NC	When required	0.74	1.41	2.17	2.54	6.86	1.00	1.86	2.44	2.31	7.61
T ₃	VC	When required	1.08	1.83	2.67	2.83	8.41	1.30	2.05	2.75	2.43	8.53
T ₄	FYM	10 Days	0.95	1.67	2.33	2.69	7.64	1.13	2.00	2.67	2.42	8.22
T ₅	FYM	20 Days	0.75	1.50	2.17	2.67	7.09	1.00	1.89	2.64	2.32	7.85
T ₆	FYM	30 Days	0.62	0.67	1.83	2.00	5.12	0.68	1.68	2.35	2.14	6.85
T ₇	NC	10 Days	0.73	1.00	2.00	2.50	6.23	0.89	1.81	2.39	2.28	7.37
T ₈	NC	20 Days	0.67	0.83	1.83	2.00	5.33	0.87	1.80	2.35	2.22	7.24
T ₉	NC	30 Days	0.57	0.67	1.58	1.49	4.31	0.43	1.26	1.67	2.10	5.46
T ₁₀	VC	10 Days	1.22	2.17	2.83	2.83	9.05	1.43	2.15	2.76	2.59	8.93
T ₁₁	VC	20 Days	1.00	1.67	2.33	2.75	7.75	1.27	2.01	2.68	2.42	8.38
T ₁₂	VC	30 Days	0.50	0.67	1.83	1.58	4.58	0.56	1.67	2.00	2.13	6.36
		F- test	S	S	S	S		S	S	S	S	
		S. Ed. (\pm)	0.13	0.22	0.30	0.34		0.14	0.20	0.34	0.39	
		C. D. (P = 0.05)	0.27	0.46	0.61	0.70		0.29	0.41	0.70	0.80	

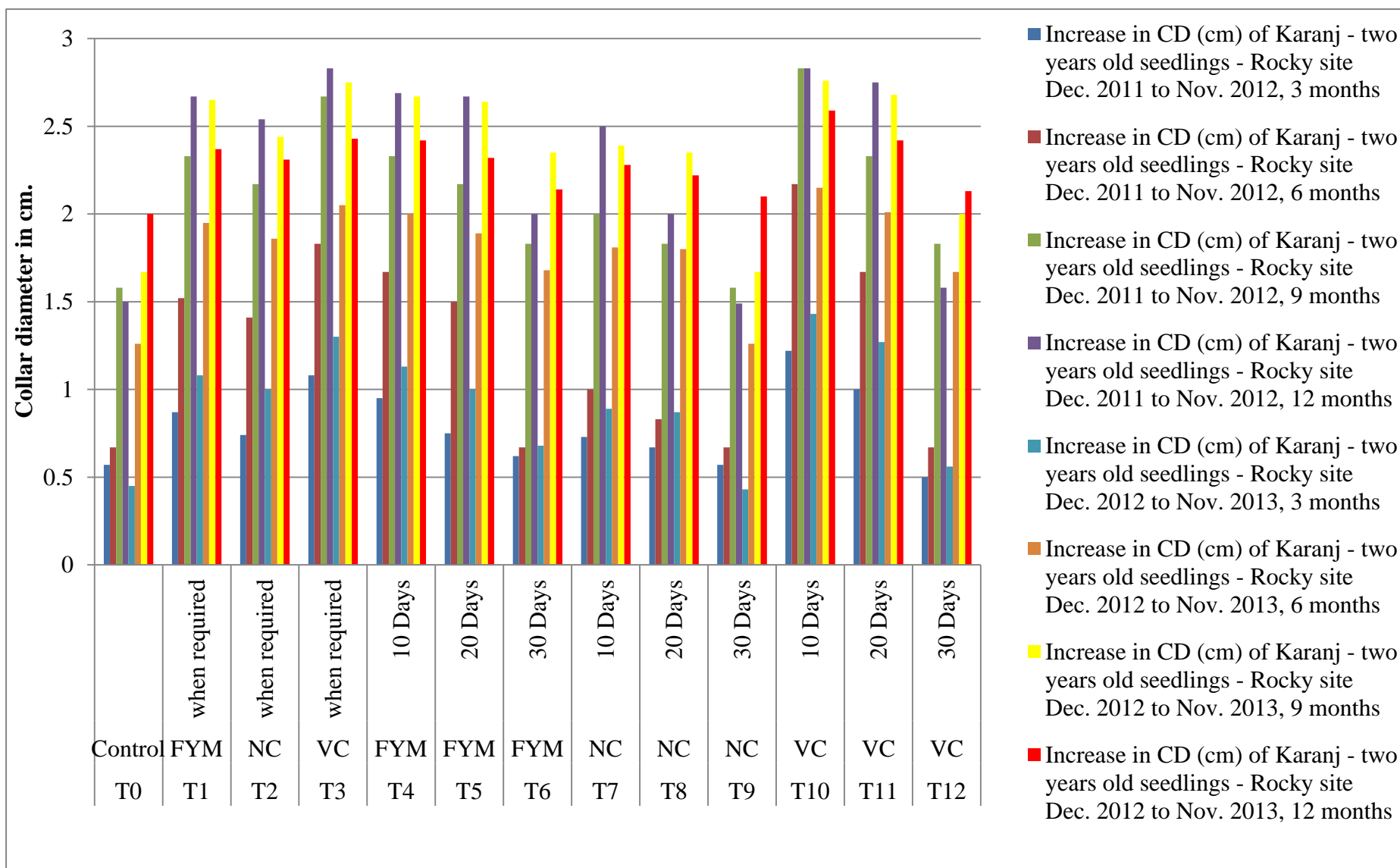


Fig.4.6.2. Increase in Collar diameter (cm) of two year old seedling of Karanj at Rocky site in December, 2011 to November, 2013.

4.6.3. Survival percentage of two year old seedling of *Pongamia pinnata* (Karanj) at Rocky site at different intervals in December, 2011 to November, 2012 and December, 2012 to November, 2013.

The Plant Survival percentage during first year (Table 4.6.3.) -

The survivality in first year of 3 month reported Karanj seedlings grown at Rocky sites with different intervals of irrigation schedule along with the applications of organic manures available or provide in a form of different treatment combinations.

The study clearly indicates non significant maximum survival percentage i.e. 100% was found in T₀, T₁, T₂, T₃, T₄ T₅, T₆, T₇, T₈, T₉, T₁₀, T₁₁ and T₁₂ treatments.

The survivality of in first year 6, 9 and 12 month reported Karanj seedlings grown at Rocky sites with different intervals of irrigation schedule along with the applications of organic manures available or provide in a form of different treatment combinations.

The study clearly indicates non significant maximum survival percentage i.e. 100% was found in T₁, T₂, T₃, T₄ T₅, T₆, T₇, T₈, T₉T₁₀ T₁₁, and T₁₂ due to good soil condition, nature of soil fertility availability essential minerals & nutrients, proper and good health condition of Karanj seedlings and its adaptability. This followed T₀ with 66.67% which shows minimum survival percentage of Karanj seedlings because of some deficiencies are found present in Rocky site with decrease physical properties of soil. Overall it is observed that treatment T₁₀ (vermicompost @ 10 days of irrigation schedule) with maximum survivality or survival % i.e. 100@ along with other attributes or observatory parameters would consider the best treatment combination.

The Plant Survival percentage during second year (Table 4.6.3.) -

The survivality in second year of 3 month reported Karanj seedlings grown at Rocky sites with different intervals of irrigation schedule along with the applications of organic manures available or provide in a form of different treatment combinations.

The study clearly indicates significant maximum survival percentage i.e. 100% was found in T₁, T₂, T₃, T₄ T₅, T₆, T₇, T₈, T₉, T₁₀, T₁₁ and T₁₂ due to good soil condition, nature of soil fertility availability essential minerals & nutrients, proper and

good health condition of Karanj seedlings and its adaptability and treatment T₀ (control) which shows (33.33%) minimum survival percentage of Karanj seedlings.

The survivability in second year of 6, 9 and 12 month reported Karanj seedlings grown at Rocky sites with different intervals of irrigation schedule along with the applications of organic manures available or provide in a form of different treatment combinations.

The study clearly indicates significant maximum survival percentage i.e. 100% was found in T₁, T₂, T₃, T₄, T₅, T₆, T₇, T₈, T₁₀, T₁₁ and T₁₂ due to good soil condition, nature of soil fertility availability essential minerals & nutrients, proper and good health condition of Karanj seedlings and its adaptability. This followed T₉ with 66.67% and treatment T₀ (control) which shows (33.33%) minimum survival percentage of Karanj seedlings because of some deficiencies are found present in Rocky site or decrease in physical nature of soil. Overall it is observed that treatment T₁₀ (vermicompost @ 10 days of irrigation schedule) with maximum survivability or survival % i.e. 100% along with other attributes or observatory parameters would consider the best treatment combination.

Table 4.6.3. Survival percentage of two years old seedlings of Karanj (*Pongamia pinnata*) at Rocky site at different intervals (Year-wise)

Treatment No.	Treatment		Survival percentage of Karanj - two years old seedlings - Rocky site									
			December, 2011 to November, 2012					December, 2012 to November, 2013				
			3 months	6 months	9 months	12 months	Total	3 months	6 months	9 months	12 months	Total
T ₀	Control		100.00	66.67	66.67	66.67	66.67	33.33	33.33	33.33	33.33	33.33
T ₁	FYM	When required	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₂	NC	When required	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₃	VC	When required	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₄	FYM	10 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₅	FYM	20 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₆	FYM	30 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₇	NC	10 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₈	NC	20 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₉	NC	30 Days	100.00	100.00	100.00	100.00	100.00	100.00	66.67	66.67	66.67	66.67
T ₁₀	VC	10 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₁₁	VC	20 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₁₂	VC	30 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
		F- test	NS	NS	NS	NS		S	S	S	S	
		S. Ed. (±)	-	-	-	-		13.07	18.10	18.10	18.10	
		C. D. (P = 0.05)	-	-	-	-		26.99	37.36	37.36	37.36	

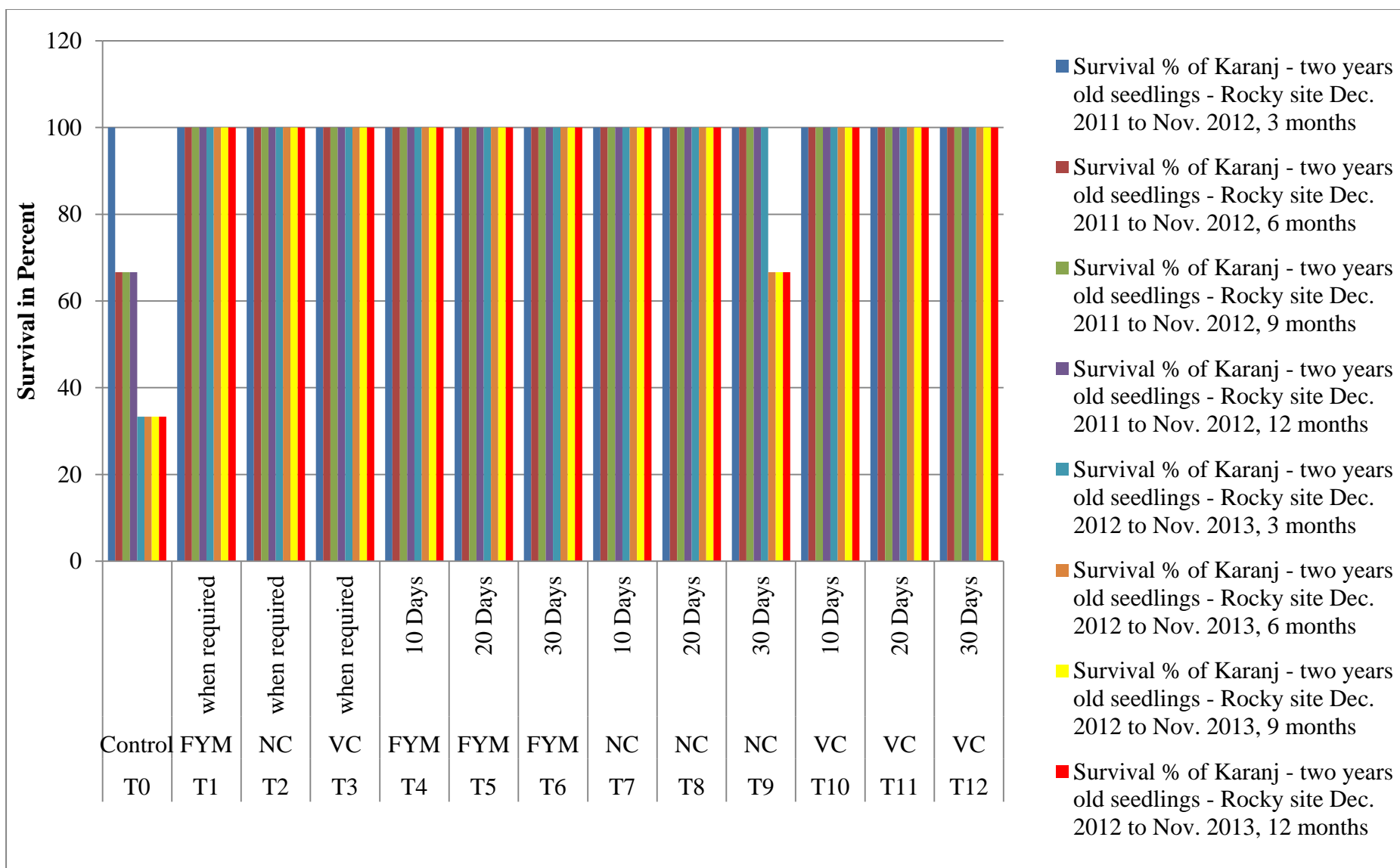


Fig.4.6.3. Increase in Collar diameter (cm) of two year old seedling of Karanj at Rocky site in December, 2011 to November, 2013.

4.7. Six month old seedling plantation of *Emblica officinalis* (Aonla) at Rocky site:

4.7.1. Increase in plant height of *Emblica officinalis* (Aonla) – 6 month old seedling at Rocky site in December, 2011 to November, 2012 and December, 2012 to November, 2013.

The Plant height during first year (Table 4.7.1.) -

Plant height after 3 month (1.40cm) was observed maximum in the treatment T₁₀ and followed by T₃ (1.30cm), T₁₁ (1.30cm) and T₄ (1.20cm) however, minimum was recorded in T₀ (0.30cm).

Plant height after 6 month (2.50cm) was observed maximum in T₁₀ and followed by T₃ (2.10cm), T₁₁ (1.93cm) and T₄ (1.70cm). However, minimum was recorded in T₀ (0.50cm).

Plant height after 9 month (10.03cm) was observed maximum in T₁₀ and followed by T₃ (9.50cm), T₁₁ (9.36cm) and T₄ (8.64cm). However, minimum was recorded in T₀ (1.40cm).

Plant height after 12 month (14.70cm) was observed maximum in T₁₀ and followed by T₃ (13.80cm), T₁₁ (12.90cm) and T₄ (12.47cm). However, minimum was recorded in T₀ (1.33cm). Other organic manure and irrigation schedule showed the significant difference in the plant height in all monthly treatment of first year.

The Plant height during second year (Table 4.7.1.) -

Plant height after 3 month (3.20cm) was observed maximum in the treatment T₁₀ and followed by T₃ (3.19cm), T₁₁ (3.14cm) and T₄ (3.08cm). However, minimum was recorded in T₀ (1.80cm).

Plant height after 6 month (2.47cm) was observed maximum in T₁₀ and followed by T₃ (3.19cm), T₁₁ (3.14cm) and T₄ (3.08cm). However, minimum was recorded in T₀ (0.95cm).

Plant height after 9 month (17.17cm) was observed maximum in T₁₀ and followed by T₃ (2.37cm), T₁₁ (2.27cm) and T₄ (2.13cm). However, minimum was recorded in T₀ (1.40cm).

Plant height after 12 month (16.83cm) was observed maximum in T₁₀ and followed by T₃ (16.14cm), T₁₁ (15.85cm) and T₄ (14.06cm). However, minimum was recorded in T₀ (1.27cm). Other organic manure and irrigation schedule showed the significant difference in the plant height in all monthly treatment of second year.

Table 4.7.1. Increase in plant height (cm) of six months old seedlings of Aonla (*Emblica officinalis*) at Rocky site at different intervals (Year-wise)

Treatment No.	Treatment		Increase in plant height (cm) of Aonla - 6 months old seedlings - Rocky site									
	Organic manure	Irrigation schedule	December, 2011 to November, 2012					December, 2012 to November, 2013				
			3 month hs	6 month s	9 month s	12 month s	Total	3 month s	6 month s	9 month s	12 month s	Total
T ₀	Control		0.30	0.50	1.40	1.33	3.53	1.80	1.00	1.40	1.27	5.47
T ₁	FYM	When required	1.30	1.77	9.00	12.60	24.66	3.12	2.19	14.48	15.45	35.24
T ₂	NC	When required	1.03	1.40	7.97	10.83	21.23	3.01	1.87	9.37	13.40	27.65
T ₃	VC	When required	1.30	2.10	9.50	13.80	26.70	3.19	2.37	15.83	16.14	37.52
T ₄	FYM	10 Days	1.20	1.70	8.64	12.47	24.01	3.08	2.13	13.95	14.06	33.22
T ₅	FYM	20 Days	1.20	1.53	8.06	11.15	21.95	3.04	1.95	10.08	14.04	29.10
T ₆	FYM	30 Days	0.80	0.73	6.09	9.60	17.22	2.25	0.95	7.82	11.08	22.10
T ₇	NC	10 Days	1.00	1.30	7.60	10.43	20.33	2.90	1.53	8.24	13.33	26.00
T ₈	NC	20 Days	0.90	1.10	7.37	10.27	19.64	2.75	1.04	8.09	13.28	25.16
T ₉	NC	30 Days	0.70	0.68	3.95	6.50	11.83	2.11	1.21	4.83	10.77	18.92
T ₁₀	VC	10 Days	1.40	2.50	10.03	14.70	28.63	3.20	2.47	17.17	16.83	39.67
T ₁₁	VC	20 Days	1.30	1.93	9.36	12.90	25.49	3.14	2.27	14.97	15.85	36.23
T ₁₂	VC	30 Days	0.90	0.87	7.36	10.13	19.25	2.36	1.04	7.90	12.15	23.45
		F- test	S	S	S	S		NS	S	S	NS	
		S. Ed. (\pm)	0.19	0.26	1.07	3.82		-	0.70	4.47	-	
		C. D. (P = 0.05)	0.39	0.54	2.21	7.89		-	1.44	9.23	-	

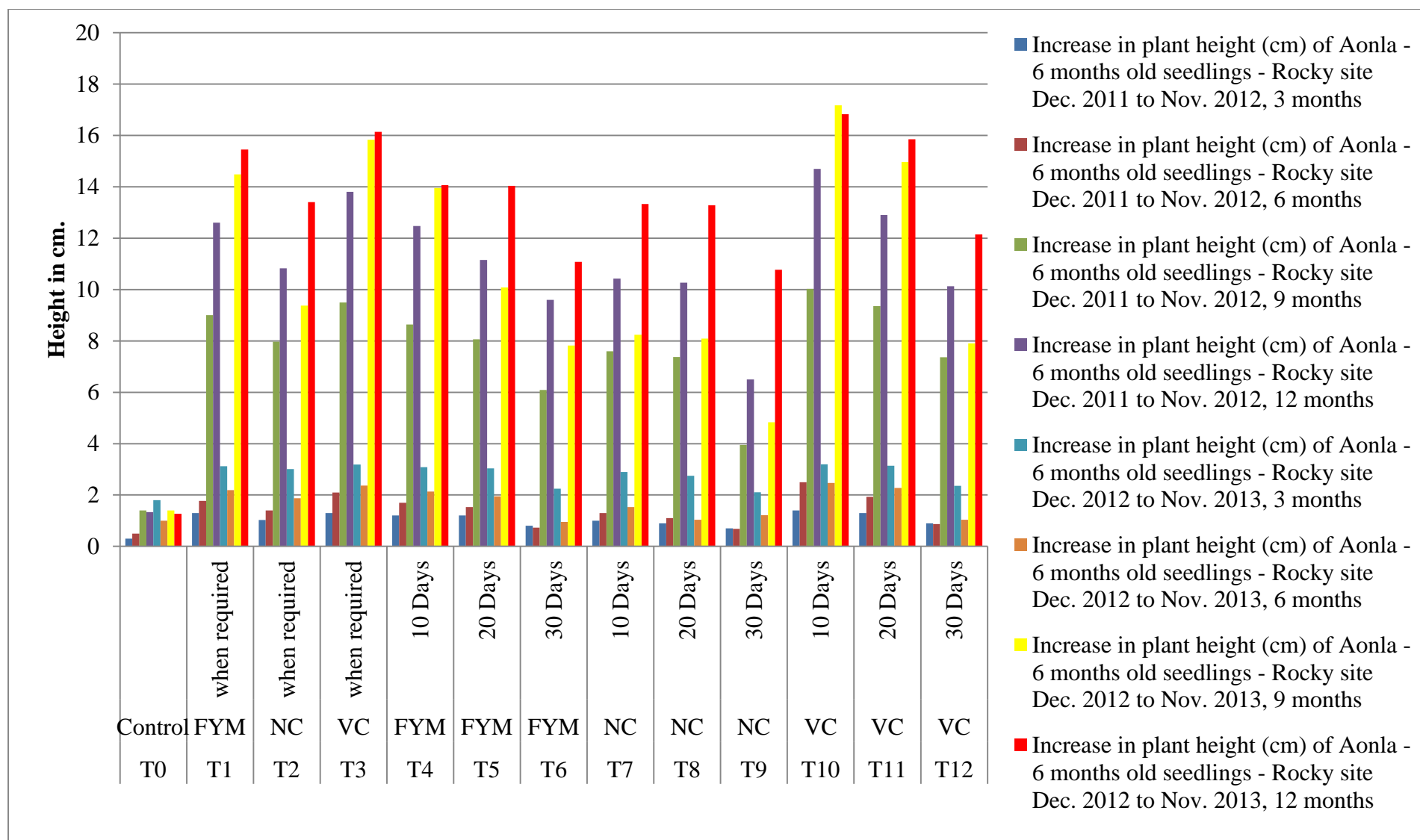


Fig. 4.7.1. Increase in plant height (cm) of Aonla– 6 month old seedling at Rocky site in December, 2011 to November, 2013.

4.7.2. Increase in Collar diameter (cm) of *Emblica officinalis* (Aonla) – 6 month old seedling at Rocky site in December, 2011 to November, 2012 and December, 2012 to November, 2013.

The Plant Collar diameter during first year (Table 4.7.2.) -

The result of the average Collar diameter after 3 month (0.17cm) was observed maximum in the treatment T₁₀, and followed by T₃ (0.17cm), T₁₁ (0.17cm) and T₄ (0.17cm), However, minimum increase Collar diameter was recorded in T₀ (0.09cm).

Collar diameter after 6 month (0.20cm) was observed maximum in T₁₀ and followed by T₃ (0.17cm), T₁₁ (0.17cm) and T₄ (0.17cm). However, minimum increase Collar diameter was recorded in T₀ (0.10cm).

Collar diameter after 9 month (1.27cm) was observed maximum in T₁₀ and followed by T₃ (1.20cm), T₁₁ (1.17cm) and T₄ (1.13cm). However, minimum increase Collar diameter was recorded in T₀ (0.72cm).

Collar diameter after 12 month (1.53cm) was observed maximum in T₁₀ and followed by T₃ (1.43cm), T₁₁ (1.30cm) and T₄ (1.19cm). However, minimum increase Collar diameter was recorded in T₀ (0.70cm). Other organic manure and irrigation schedule showed the significant differences in the plant collar diameter in all monthly treatment of first year.

The Plant Collar diameter during second year (Table 4.7.2.) -

The result of the average Collar diameter after 3 month (0.60cm) was observed maximum in the treatment T₁₀ and followed by T₃ (0.53cm), T₁₁ (0.27cm) and T₄ (0.34cm), However, minimum increase Collar diameter was recorded in T₀ (0.07cm).

Collar diameter after 6 month (1.27cm) was observed maximum in T₁₀ and followed by T₃ (1.07cm), T₁₁ (0.97cm) and T₄ (0.97cm). However, minimum increase Collar diameter was recorded in T₀ (0.13cm).

Collar diameter after 9 month (2.43cm) was observed maximum in T₁₀ and followed by T₃ (1.50cm), T₁₁ (1.50cm) and T₄ (1.38cm). However, minimum increase Collar diameter was recorded in T₀ (0.20cm).

Collar diameter after 12 month (2.10cm) was observed maximum in T₁₀ and followed by T₁₁ (2.04cm), T₃ (1.80cm) and T₄ (1.47cm). However, minimum increase Collar diameter was recorded in T₀ (0.15cm). Other organic manure and irrigation schedule showed the significant differences in the plant collar diameter in all monthly treatment of second year.

Table 4.7.2. Increase in collar diameter (cm) of six months old seedlings of Aonla (*Emblica officinalis*) at Rocky site at different intervals (Year-wise)

Treatment No.	Treatment		Increase in collar diameter (cm) of Aonla - 6 months old seedlings - Rocky site									
			December, 2011 to November, 2012					December, 2012 to November, 2013				
			3 months	6 months	9 months	12 months	Total	3 months	6 months	9 months	12 months	Total
T ₀	Control		0.09	0.10	0.72	0.70	1.61	0.07	0.13	0.20	0.15	0.55
T ₁	FYM	When required	0.17	0.17	1.13	1.27	2.73	0.37	0.97	1.43	1.50	4.27
T ₂	NC	When required	0.17	0.17	1.03	1.10	2.47	0.31	0.76	1.24	1.20	3.51
T ₃	VC	When required	0.17	0.17	1.20	1.43	2.97	0.53	1.07	1.50	1.80	4.90
T ₄	FYM	10 Days	0.17	0.17	1.13	1.19	2.66	0.34	0.97	1.38	1.47	4.16
T ₅	FYM	20 Days	0.17	0.17	1.13	1.13	2.59	0.33	0.87	1.37	1.30	3.87
T ₆	FYM	30 Days	0.10	0.17	0.86	0.98	2.11	0.27	0.55	0.93	1.00	2.75
T ₇	NC	10 Days	0.10	0.17	0.97	1.04	2.28	0.30	0.70	1.24	1.20	3.43
T ₈	NC	20 Days	0.10	0.17	0.90	1.03	2.20	0.30	0.67	1.18	1.08	3.23
T ₉	NC	30 Days	0.10	0.10	0.75	0.82	1.77	0.19	0.50	0.74	0.80	2.23
T ₁₀	VC	10 Days	0.17	0.20	1.27	1.53	3.17	0.60	1.27	2.43	2.10	6.40
T ₁₁	VC	20 Days	0.17	0.17	1.17	1.30	2.80	0.43	0.97	1.50	2.04	4.94
T ₁₂	VC	30 Days	0.10	0.17	0.86	1.00	2.12	0.27	0.67	1.13	0.92	2.99
		F- test	S	S	S	NS		S	S	S	NS	
		S. Ed. (\pm)	0.01	0.02	0.19	-		0.12	0.29	0.54	-	
		C. D. (P = 0.05)	0.02	0.04	0.39	-		0.24	0.61	1.11	-	

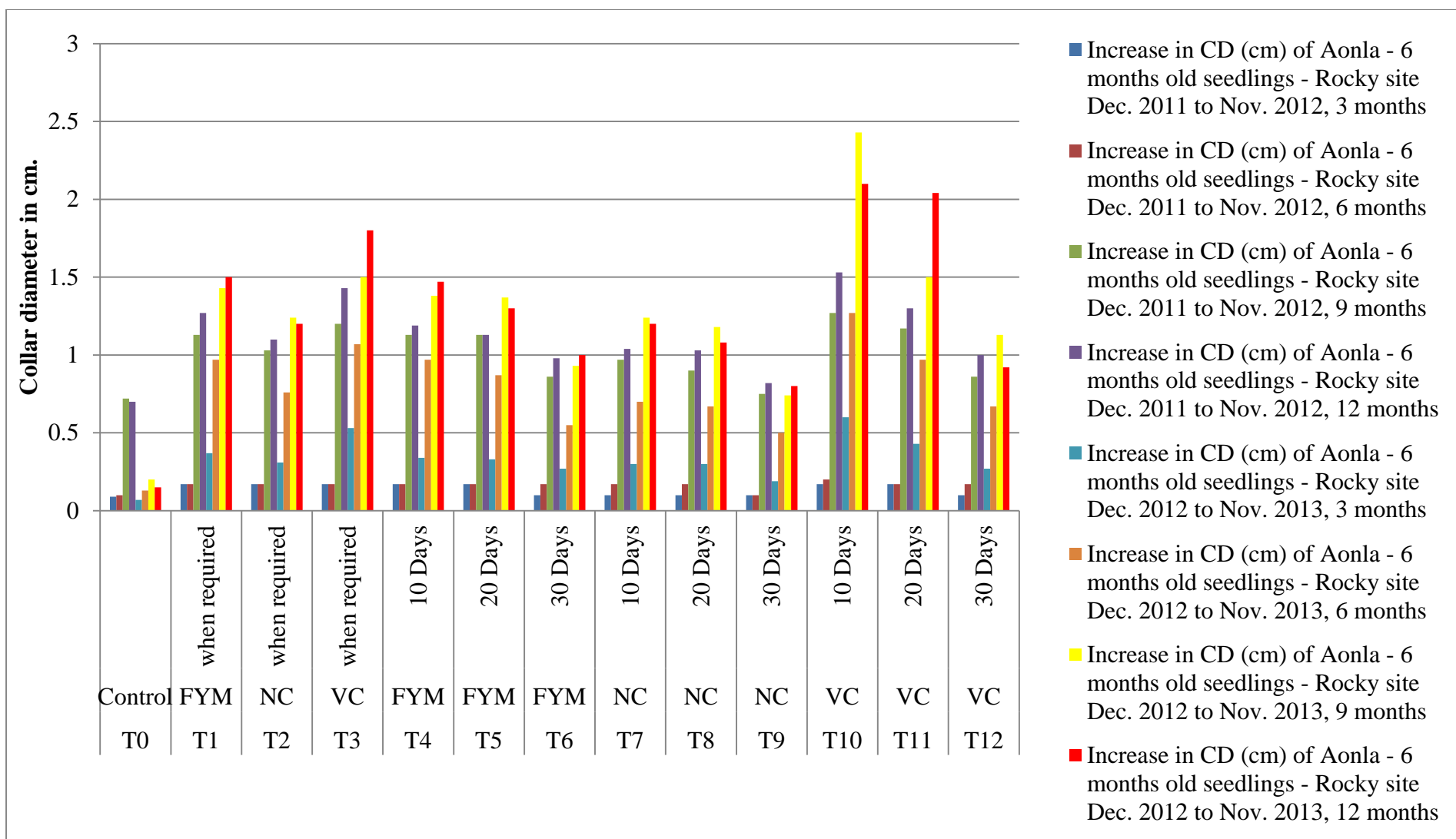


Fig. 4.7.2. Increase in Collar diameter (cm) of Aonla– 6 month old seedling at Rocky site in December, 2011 to November, 2013.

4.7.3. Survival percentage of six month old seedling of *Emblica officinalis* (Aonla) at Rocky Sites at different intervals in December, 2011 to November, 2012 and December, 2012 to November, 2013.

The Plant Survival percentage during first year (Table 4.7.3.) -

The survivability in first year of 3 month reported Aonla seedlings grown at rocky sites with different intervals of irrigation schedule along with the applications of organic manures available or provide in a form of different treatment combinations.

The study clearly indicates non significant maximum survival percentage i.e. 100% was found in T₁, T₂, T₃, T₄, T₅, T₆, T₇, T₈, T₉, T₁₀, T₁₁ and T₁₂ treatment.

The survivability in first year of 6 month reported Aonla seedlings grown at rocky sites with different intervals of irrigation schedule along with the applications of organic manures available or provide in a form of different treatment combinations.

The study clearly indicates non significant maximum survival percentage i.e. 100% was found in T₁, T₂, T₃, T₄, T₅, T₆, T₇, T₈, T₁₀, T₁₁ and T₁₂ treatment.

The survivability in first year of 9 month reported Aonla seedlings grown at rocky sites with different intervals of irrigation schedule along with the applications of organic manures available or provide in a form of different treatment combinations.

The study clearly indicates non significant maximum survival percentage i.e. 100% was found in T₁, T₂, T₃, T₄, T₅, T₇, T₈, T₁₀, T₁₁ and T₁₂ Treatment.

The survivability in first year of 12 month reported Aonla seedlings grown at rocky sites with different intervals of irrigation schedule along with the applications of organic manures available or provide in a form of different treatment combinations.

The study clearly indicates non significant maximum survival percentage i.e. 100% was found in T₁, T₃, T₁₀ and T₁₁ due to good soil condition, nature of soil fertility availability essential minerals & nutrients, proper and good health condition of aonla seedlings and its adaptability. This followed T₂, T₄, T₅, T₆, T₇, T₈, T₉, T₁₂ with 66.67% and the minimum survival percentage treatment T₀ (control) which shows (33.33%) minimum survival percentage of aonla seedlings because of some deficiencies are found present in rocky site or decrease in physical nature of soil. Overall it is observed that treatment T₁₀ (vermicompost @ 10 days of irrigation schedule) with maximum

survivality or survival % i.e. 100@ along with other attributes or observatory parameters would consider the best treatment combination.

The Plant Survival percentage during second year (Table 4.7.3.) -

The survivality in second year of 3 month reported Aonla seedlings grown at Rocky sites with different intervals of irrigation schedule along with the applications of organic manures available or provide in a form of different treatment combinations.

The study clearly indicates non significant maximum survival percentage i.e. 100% was found in T₁, T₃, T₁₀ and T₁₁ Treatment.

The survivality in second year of 6 month reported Aonla seedlings grown at Rocky sites with different intervals of irrigation schedule along with the applications of organic manures available or provide in a form of different treatment combinations.

The study clearly indicates non significant maximum survival percentage i.e. 100% was found in T₃, T₁₀ and T₁₁ Treatment.

The survivality in second year of 9 and 12 month reported Aonla seedlings grown at Rocky sites with different intervals of irrigation schedule along with the applications of organic manures available or provide in a form of different treatment combinations.

The study clearly indicates non significant maximum survival percentage i.e. 100% was found in T₃, T₁₀ and due to good soil condition, nature of soil fertility availability essential minerals & nutrients, proper and good health condition of aonla seedlings and its adaptability. This followed T₁, T₂, T₄, T₅, T₇, T₈, T₁₁ and T₁₂ with 66.67% and treatment T₀, T₆ and T₉ which shows (33.33%) minimum survival percentage of aonla seedlings because of some deficiencies are found present in rocky site or decrease in physical nature of soil. Overall it is observed that treatment T₁₀ (vermicompost @ 10 days of irrigation schedule) with maximum survivality or survival % i.e. 100@ along with other attributes or observatory parameters would consider the best treatment combination.

Table 4.7.3. Survival percentage of six months old seedlings of Aonla (*Emblica officinalis*) at Rocky site at different intervals (Year-wise)

Treatment No.	Treatment		Survival percentage of Aonla - 6 months old seedlings - Rocky site									
			December, 2011 to November, 2012					December, 2012 to November, 2013				
			3 months	6 months	9 months	12 months	Total	3 months	6 months	9 months	12 months	Total
T ₀	Control		66.67	33.33	33.33	33.33	33.33	33.33	33.33	33.33	33.33	33.33
T ₁	FYM	When required	100.00	100.00	100.00	100.00	100.00	100.00	66.67	66.67	66.67	66.67
T ₂	NC	When required	100.00	100.00	100.00	66.67	66.67	66.67	66.67	66.67	66.67	66.67
T ₃	VC	When required	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₄	FYM	10 Days	100.00	100.00	100.00	66.67	66.67	66.67	66.67	66.67	66.67	66.67
T ₅	FYM	20 Days	100.00	100.00	100.00	66.67	66.67	66.67	66.67	66.67	66.67	66.67
T ₆	FYM	30 Days	100.00	100.00	66.67	66.67	66.67	33.33	33.33	33.33	33.33	33.33
T ₇	NC	10 Days	100.00	100.00	100.00	66.67	66.67	66.67	66.67	66.67	66.67	66.67
T ₈	NC	20 Days	100.00	100.00	100.00	66.67	66.67	66.67	66.67	66.67	66.67	66.67
T ₉	NC	30 Days	100.00	66.67	66.67	66.67	66.67	33.33	33.33	33.33	33.33	33.33
T ₁₀	VC	10 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₁₁	VC	20 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	66.67	66.67	66.67
T ₁₂	VC	30 Days	100.00	100.00	100.00	66.67	66.67	66.67	66.67	66.67	66.67	66.67
		F- test	NS	NS	NS	NS		NS	NS	NS	NS	
		S. Ed. (\pm)	-	-	-	-		-	-	-	-	
		C. D. (P = 0.05)	-	-	-	-		-	-	-	-	

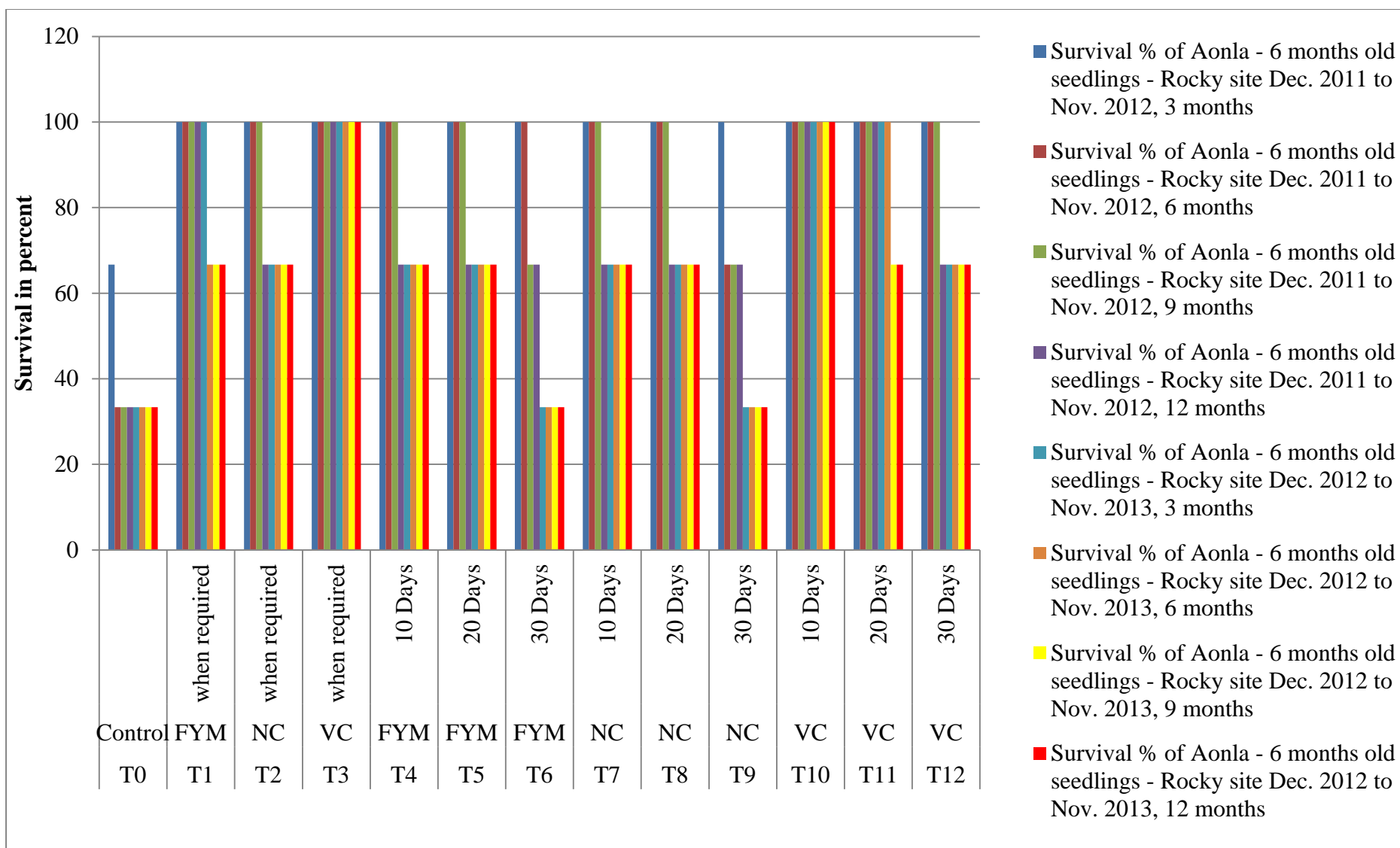


Fig. 4.7.3. Survival percentage of Aonla– 6 month old seedling at Rocky site in December, 2011 to November, 2013.

4.8. One year old seedling plantation of *Emblica officinalis* (Aonla) at Rocky site:

4.8.1. Increase in plant height (cm) of one year old seedling of *Emblica officinalis* (Aonla) at Rocky site in December, 2011 to November, 2012 and December, 2012 to November, 2013.

The Plant height during first year (Table 4.8.1.) -

The result of the average plant height after 3 month (1.80cm) was observed maximum in the treatment T₁₀ and followed by T₃ (1.60cm), T₁₁ (1.40cm) and T₄ (1.20cm). However, minimum was recorded in T₀ (0.50cm).

Plant height after 6 month (3.23cm) was observed maximum in T₁₀ and followed by T₃ (2.87cm), T₁₁ (2.67cm) and T₄ (2.33cm). However, minimum was recorded in T₀ (0.50cm).

Plant height after 9 month (17.93cm) was observed maximum in T₁₀ and followed by T₃ (17.03cm), T₁₁ (16.47cm) and T₄ (15.57cm). However, minimum was recorded in T₀ (1.83cm).

Plant height after 12 month (26.47cm) was observed maximum in T₁₀ and followed by T₃ (24.13cm), T₁₁ (23.27cm) and T₄ (22.83cm). However, minimum was recorded in T₀ (4.10cm). Other organic manure and irrigation schedule showed the significant difference in the plant height in all monthly treatment of first year.

The Plant height during second year (Table 4.8.1.) -

Plant height after 3 month (5.06cm) was observed maximum in the treatment T₁₀ and followed by T₃ (4.53cm), T₁₁ (4.34cm) and T₄ (4.28cm). However, minimum was recorded in T₀ (1.20cm).

Plant height after 6 month (3.87cm) was observed maximum in T₁₀ and followed by T₃ (3.60cm), T₁₁ (3.43cm) and T₄ (3.30cm). However, minimum was recorded in T₀ (2.20cm).

Plant height after 9 month (20.07cm) was observed maximum in T₁₀ and followed by T₃ (18.93cm), T₁₁ (17.83cm) and T₄ (16.90cm). However, minimum was recorded in T₀ (8.00cm).

Plant height after 12 month (21.80cm) was observed maximum in T₁₀ and followed by T₃ (20.43cm), T₁₁ (19.90cm) and T₄ (19.00cm). However, minimum was recorded in T₀ (3.70cm). Other organic manure and irrigation schedule showed the significant difference in the plant height in all monthly treatment of second year.

Table 4.8.1. Increase in plant height (cm) of one year old seedlings of Aonla (*Emblca officinalis*) at Rocky site at different intervals (Year-wise)

Treatment No.	Treatment		Increase in plant height (cm) of Aonla - one year old seedlings - Rocky site									
	Organic manure	Irrigation schedule	December, 2011 to November, 2012					December, 2012 to November, 2013				
			3 months	6 months	9 months	12 months	Total	3 months	6 months	9 months	12 months	Total
T ₀	Control		0.50	0.50	1.83	4.10	6.93	1.20	2.20	8.00	3.70	15.10
T ₁	FYM	When required	1.30	2.53	15.67	23.00	42.50	4.32	3.33	17.50	19.03	44.19
T ₂	NC	When required	1.10	2.10	14.83	21.57	39.60	4.23	3.07	15.50	18.13	40.93
T ₃	VC	When required	1.60	2.87	17.03	24.13	45.63	4.53	3.60	18.93	20.43	47.50
T ₄	FYM	10 Days	1.20	2.33	15.57	22.83	41.93	4.28	3.30	16.90	19.00	43.48
T ₅	FYM	20 Days	1.10	2.20	14.97	22.20	40.47	4.27	3.17	16.80	18.47	42.70
T ₆	FYM	30 Days	0.90	1.47	8.60	14.57	25.53	2.33	2.00	9.77	15.25	29.35
T ₇	NC	10 Days	0.90	2.07	13.33	20.67	36.97	4.17	2.83	14.17	15.97	37.13
T ₈	NC	20 Days	0.90	1.67	11.80	16.30	30.67	2.53	2.40	13.93	15.57	34.43
T ₉	NC	30 Days	0.70	1.01	6.89	12.20	20.80	1.27	1.99	8.73	13.07	25.06
T ₁₀	VC	10 Days	1.80	3.23	17.93	26.47	49.43	5.06	3.87	20.07	21.80	50.79
T ₁₁	VC	20 Days	1.40	2.67	16.47	23.27	43.80	4.34	3.43	17.83	19.90	45.51
T ₁₂	VC	30 Days	0.90	1.63	9.60	15.87	28.00	2.37	2.32	12.16	15.32	32.17
		F- test	S	S	S	S		S	S	S	S	
		S. Ed. (\pm)	0.25	0.31	0.19	0.71		0.22	0.53	1.95	2.89	
		C. D. (P = 0.05)	0.51	0.65	0.40	1.46		0.46	1.10	4.03	5.97	

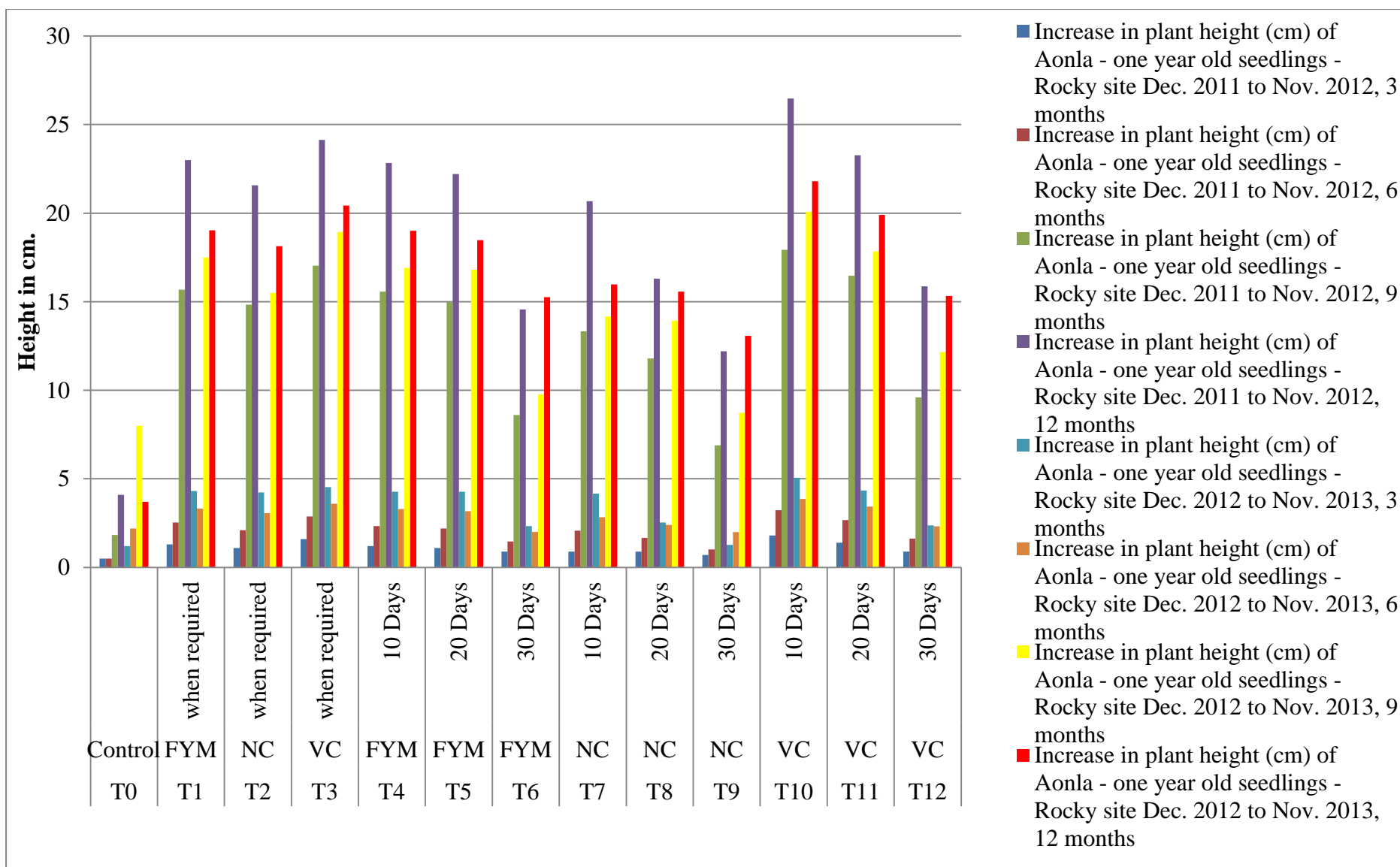


Fig. 4.8.1. Increase in plant height (cm) of one year old seedling of Aonla at Rocky site in December, 2011 to November, 2013.

4.8.2. Increase in Collar diameter (cm) of one year old seedling of *Emblica officinalis* (Aonla) at Rocky site in December, 2011 to November, 2012 and December, 2012 to November, 2013.

The Plant Collar diameter during first year (Table 4.8.2.) -

The result of the average Collar diameter after 3 month (0.20cm) was observed maximum in the treatment T_{10} and followed by T_3 (0.20cm), T_{11} (0.20cm) and T_4 (0.17cm), However, minimum increase Collar diameter was recorded in T_0 (0.08m).

Collar diameter after 6 month (0.33cm) was observed maximum in T_{10} and followed by T_3 (0.30cm), T_{11} (0.30cm) and T_4 (0.23cm). However, minimum increase Collar diameter was recorded in T_0 (0.12cm).

Collar diameter after 9 month (1.54cm) was observed maximum in T_{10} and followed by T_3 (1.33cm), T_{11} (1.33cm) and T_4 (1.23cm). However, minimum increase Collar diameter was recorded in T_0 (0.57cm).

Collar diameter after 12 month (2.13cm) was observed maximum in T_{10} and followed by T_3 (1.70cm), T_{11} (1.60cm) and T_4 (1.57cm). However, minimum increase Collar diameter was recorded in T_0 (0.63cm). Other organic manure and irrigation schedule showed the significant differences in the plant collar diameter in all monthly treatment in first year.

The Plant Collar diameter during second year (Table 4.8.2.) -

The result of the average Collar diameter after 3 month (0.60cm) was observed maximum in the treatment T_{10} and followed by T_3 (0.57cm), T_{11} (0.47cm) and T_4 (0.43cm), However, minimum increase Collar diameter was recorded in T_0 (0.15cm).

Collar diameter after 6 month (1.93cm) was observed maximum in T_{10} and followed by T_3 (1.73cm), T_{11} (1.70cm) and T_4 (1.47cm). However, minimum increase Collar diameter was recorded in T_0 (0.56cm).

Collar diameter after 9 month (2.17cm) was observed maximum in T_{10} and followed by T_3 (2.07cm), T_{11} (1.93cm) and T_4 (1.87cm). However, minimum increase Collar diameter was recorded in T_0 (0.60cm).

Collar diameter after 12 month (1.80cm) was observed maximum in T₇ and followed by T₃ (1.76cm), T₁₁ (1.57cm) and T₄ (1.53cm). However, minimum increase Collar diameter was recorded in T₉ control (0.35cm). While as other organic manure and irrigation schedule showed the significant differences in the plant collar diameter in all monthly treatment of second year.

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Table 4.8.2. Increase in collar diameter (cm) of one year old seedlings of Aonla (*Emblica officinalis*) at Rocky site at different intervals (Year-wise)

Treatment No.	Treatment		Increase in collar diameter (cm) of Aonla - one year old seedlings - Rocky site									
			December, 2011 to November, 2012					December, 2012 to November, 2013				
			3 months	6 months	9 months	12 months	Total	3 months	6 months	9 months	12 months	Total
T ₀	Control		0.08	0.12	0.57	0.63	1.40	0.15	0.56	0.60	0.35	1.65
T ₁	FYM	When required	0.20	0.23	1.30	1.60	3.33	0.43	1.63	1.90	1.57	5.53
T ₂	NC	When required	0.13	0.20	1.13	1.43	2.90	0.43	1.07	1.70	1.30	4.50
T ₃	VC	When required	0.20	0.30	1.33	1.70	3.53	0.57	1.73	2.07	1.76	6.13
T ₄	FYM	10 Days	0.17	0.23	1.23	1.57	3.20	0.43	1.47	1.87	1.53	5.30
T ₅	FYM	20 Days	0.13	0.20	1.17	1.50	3.00	0.43	1.30	1.83	1.40	4.97
T ₆	FYM	30 Days	0.10	0.17	0.87	1.00	2.13	0.30	0.74	1.40	1.16	3.60
T ₇	NC	10 Days	0.13	0.20	1.10	1.33	2.77	0.43	0.97	1.70	1.30	4.40
T ₈	NC	20 Days	0.13	0.17	0.96	1.17	2.43	0.37	0.87	1.63	1.27	4.13
T ₉	NC	30 Days	0.10	0.17	0.80	0.90	1.97	0.23	0.64	0.93	0.88	2.68
T ₁₀	VC	10 Days	0.20	0.33	1.54	2.13	4.20	0.60	1.93	2.17	1.80	6.50
T ₁₁	VC	20 Days	0.20	0.30	1.33	1.60	3.43	0.47	1.70	1.93	1.57	5.67
T ₁₂	VC	30 Days	0.13	0.17	0.90	1.10	2.30	0.30	0.82	1.56	1.21	3.89
		F- test	S	S	S	S		S	S	S	NS	
		S. Ed. (\pm)	0.01	0.01	0.02	0.06		0.02	0.23	0.23	-	
		C. D. (P = 0.05)	0.01	0.02	0.04	0.13		0.04	0.48	0.48	-	

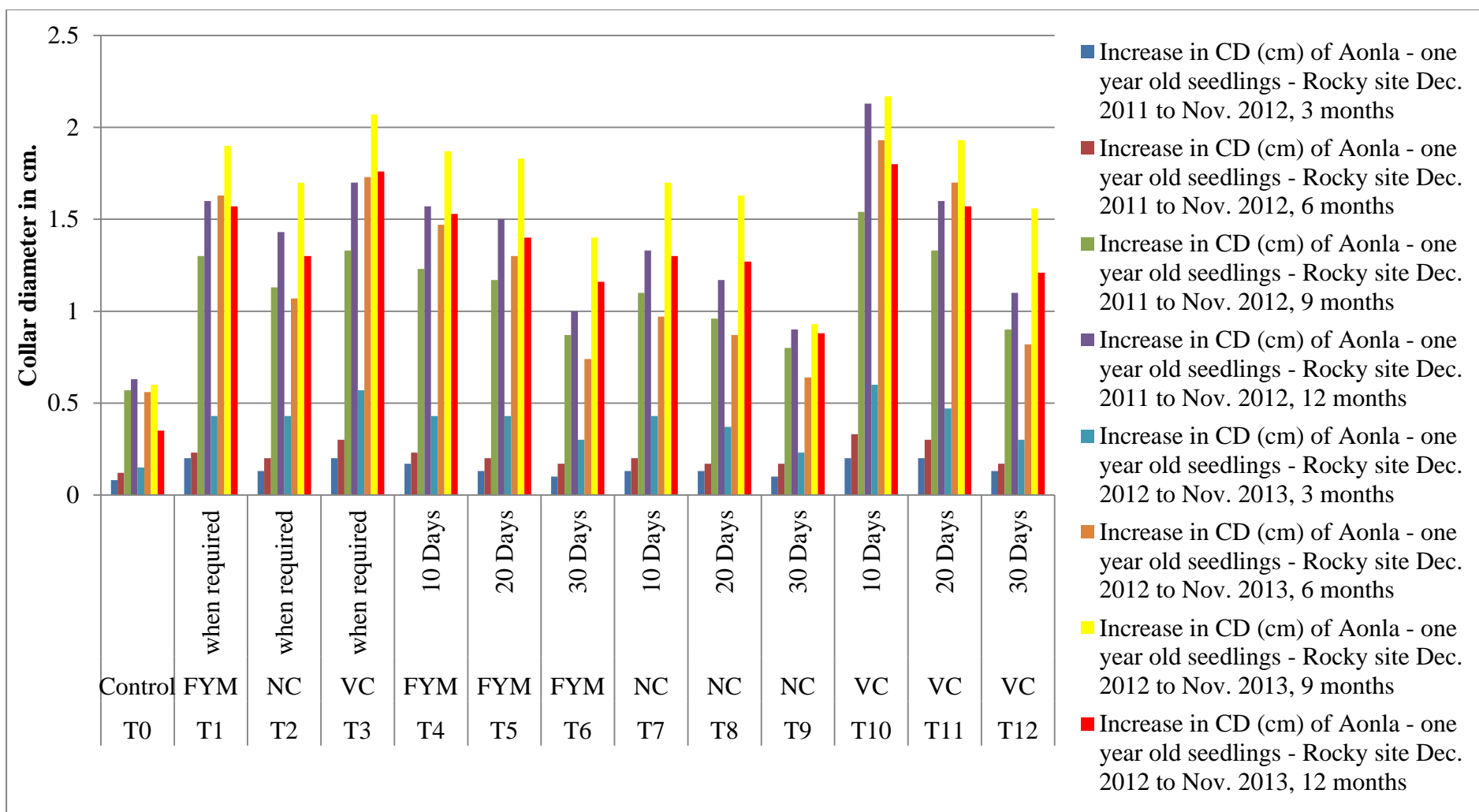


Fig. 4.8.2. Increase in Collar diameter (cm) of Aonla– one year old seedling at Rocky site in December, 2011 to November, 2013.

4.8.3. Survival percentage of one year old seedling of *Emblica officinalis* (Aonla) at Rocky Sites at different intervals in December, 2011 to November, 2012 and December, 2012 to November, 2013.

The Plant Survival percentage during first year (Table 4.8.3.) -

The survivality in first year of 3, 6, 9 and 12 month reported Aonla seedlings grown at rocky sites with different intervals of irrigation schedule along with the applications of organic manures available or provide in a form of different treatment combinations.

The study clearly indicates non significant maximum survival percentage i.e. 100% was found in T₀, T₁, T₂, T₃, T₄ T₅, T₆, T₇, T₈, T₉, T₁₀, T₁₁ and T₁₂ due to good soil condition, nature of soil fertility availability essential minerals & nutrients, proper and good health condition of Aonla seedlings and its adaptability. Overall it is observed that treatment T₁₀ (vermicompost @ 10 days of irrigation schedule) with maximum survivality or survival % i.e. 100@ along with other attributes or observatory parameters would consider the best treatment combination.

The Plant Survival percentage during second year (Table 4.8.3.) -

The survivality in second year of 3 month reported Aonla seedlings grown at rocky sites with different intervals of irrigation schedule along with the applications of organic manures available or provide in a form of different treatment combinations.

The study clearly indicates non significant maximum survival percentage i.e. 100% was found in T₁, T₂, T₃, T₄ T₅, T₆, T₇, T₈, T₉, T₁₀, T₁₁ and T₁₂ treatment.

The survivality in second year of 6 month reported Aonla seedlings grown at rocky sites with different intervals of irrigation schedule along with the applications of organic manures available or provide in a form of different treatment combinations.

The study clearly indicates non significant maximum survival percentage i.e. 100% was found in T₁, T₂, T₃, T₄ T₅, T₇, T₈, T₁₀, T₁₁ and T₁₂ treatment.

The survivality in second year of 9 and 12 month reported Aonla seedlings grown at rocky sites with different intervals of irrigation schedule along with the

applications of organic manures available or provide in a form of different treatment combinations.

The study clearly indicates non significant maximum survival percentage i.e. 100% was found in T₁, T₂, T₃, T₄ T₅, T₇, T₈, T₁₀, T₁₁ and T₁₂ due to good soil condition, nature of soil fertility availability essential minerals & nutrients, proper and good health condition of Aonla seedlings and its adaptability followed T₆ and T₉ with 66.67% and the minimum survival percentage (33.33) was found in T₀. Overall it is observed that treatment T₁₀ (vermicompost @ 10 days of irrigation schedule) with maximum survivality or survival % i.e. 100@ along with other attributes or observatory parameters would consider the best treatment combination.

Table 4.8.3. Survival percentage of one year old seedlings of Aonla (*Emblica officinalis*) at Rocky site at different intervals (Year-wise)

Treatment No.	Treatment		Survival percentage of Aonla - one year old seedlings - Rocky site									
			December, 2011 to November, 2012					December, 2012 to November, 2013				
			3 months	6 months	9 months	12 months	Total	3 months	6 months	9 months	12 months	Total
T ₀	Control		100.00	100.00	100.00	100.00	100.00	66.67	66.67	33.33	33.33	33.33
T ₁	FYM	When required	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₂	NC	When required	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₃	VC	When required	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₄	FYM	10 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₅	FYM	20 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₆	FYM	30 Days	100.00	100.00	100.00	100.00	100.00	100.00	66.67	66.67	66.67	66.67
T ₇	NC	10 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₈	NC	20 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₉	NC	30 Days	100.00	100.00	100.00	100.00	100.00	100.00	66.67	66.67	66.67	66.67
T ₁₀	VC	10 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₁₁	VC	20 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₁₂	VC	30 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
		F- test	NS	NS	NS	NS		NS	NS	NS	NS	
		S. Ed. (\pm)	-	-	-	-		-	-	-	-	
		C. D. (P = 0.05)	-	-	-	-		-	-	-	-	

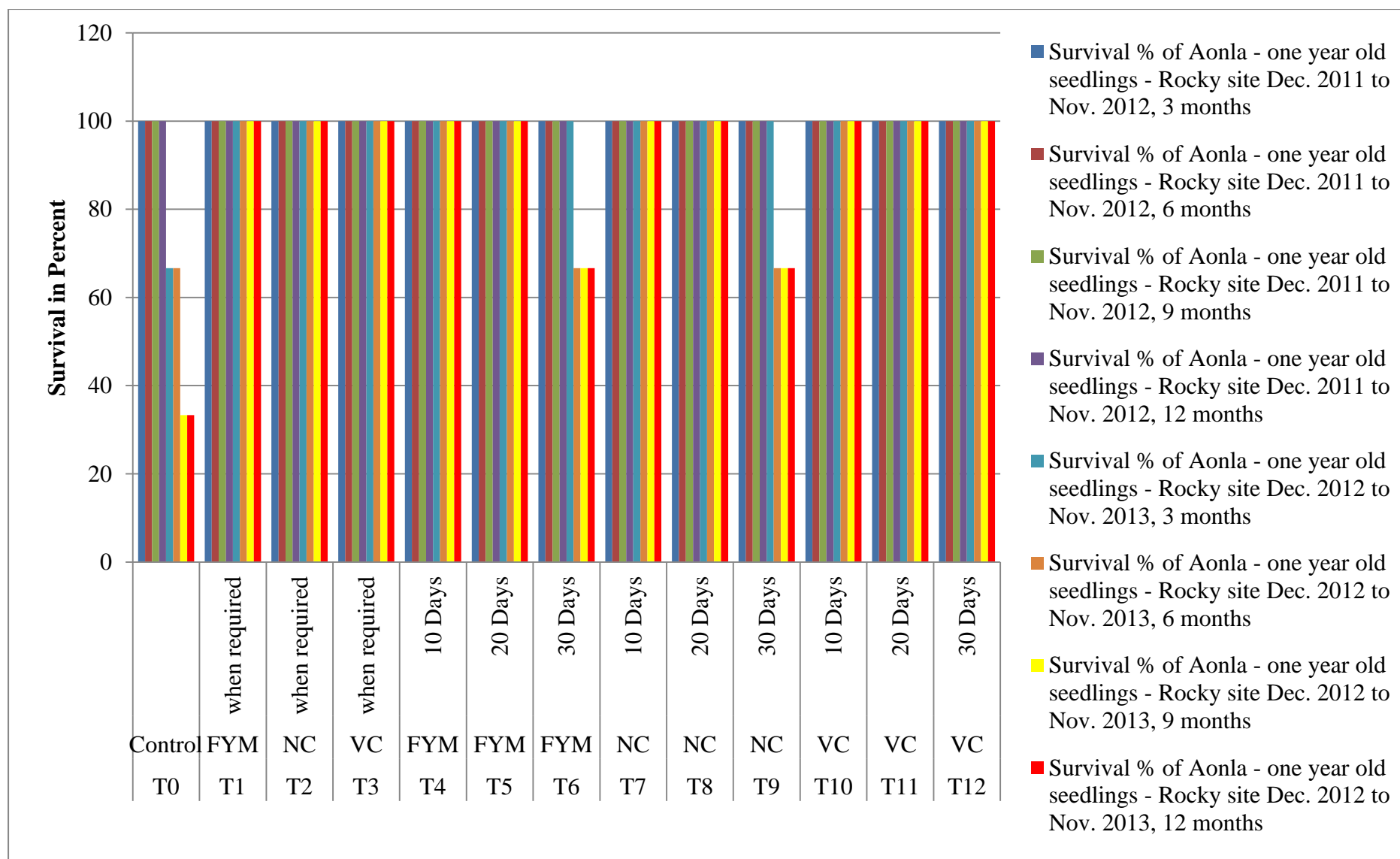


Fig. 4.8.3. Survival percentage of Aonla– one year old seedling at Rocky site in December 2011 to November 2013

4.9. Two year old seedling plantation of *Emblica officinalis* (Aonla) at Rocky site:

4.9.1. Increase in plant height (cm) of two year old seedling of *Emblica officinalis* (Aonla) at Rocky site in December, 2011 to November, 2012 and December, 2012 to November, 2013.

The Plant height during second year (Table 4.9.1.) -

The result of average plant height after 3 month (1.90cm) was observed between treatment T₁₀, T₁₁ and T₃ and followed by T₅ (1.70cm), T₁₁ (1.70cm) and T₄ (1.70cm), However, minimum was recorded in T₀ (0.33cm).

Plant height after 6 month (4.93cm) was observed maximum in T₁₀ and followed by T₃ (4.63cm), T₁₁ (4.10cm) and T₄ (3.90cm). However, minimum was recorded in T₀ (0.90cm).

Plant height after 9 month (17.77cm) was observed maximum in T₁₀ and followed by T₃ (16.73cm), T₁₁ (16.00cm) and T₄ (15.13cm). However, minimum was recorded in T₀ (2.83cm).

Plant height after 12 month (27.00cm) was observed maximum in T₁₀ and followed by T₃ (25.57cm), T₁₁ (25.07cm) and T₄ (23.57cm). However, minimum was recorded in T₀ (1.53cm). Other organic manure and irrigation schedule showed the significant difference in the plant height in all monthly treatment of first year.

The Plant height during second year (Table 4.9.1.) -

The results of the average plant height after 3 month (4.91cm) was observed maximum in the treatment T₁₀ and followed by T₃ (4.86cm), T₁₁ (4.76cm) and T₄ (4.72cm), However, minimum was recorded in T₀ (0.45cm).

Plant height after 6 month (5.83cm) was observed maximum in T₁₀ and followed by T₃ (5.73cm), T₁₁ (5.40cm) and T₄ (4.90cm). However, minimum was recorded in T₀ (1.10cm).

Plant height after 9 month (22.17cm) was observed maximum in T₁₀ and followed by T₃ (21.87cm), T₁₁ (21.70cm) and T₄ (20.07cm). However, minimum was recorded in T₀ (3.50cm).

Plant height after 12 month (26.70cm) was observed maximum in T₁₀ and followed by T₃ (24.80cm), T₁₁ (23.83cm) and T₄ (22.87cm). However, minimum was recorded in T₀ (1.20cm) Other organic manure and irrigation schedule showed the significant difference in the plant height in all monthly treatment of second year.

Table 4.9.1. Increase in plant height (cm) of two years old seedlings of Aonla (*Emblica officinalis*) at Rocky site at different intervals (Year-wise)

Treatment No.	Treatment		Increase in plant height (cm) of Aonla - two years old seedlings - Rocky site									
	Organic manure	Irrigation schedule	December, 2011 to November, 2012					December, 2012 to November, 2013				
			3 months	6 months	9 months	12 months	Total	3 months	6 months	9 months	12 months	Total
T ₀	Control		0.33	0.90	2.83	1.53	5.60	0.45	1.10	3.50	1.20	6.25
T ₁	FYM	When required	1.90	4.07	15.57	24.07	45.60	4.75	5.03	21.03	23.57	54.38
T ₂	NC	When required	1.60	3.53	14.90	21.57	41.60	4.70	4.57	19.93	20.87	50.07
T ₃	VC	When required	1.90	4.63	16.73	25.57	48.83	4.86	5.73	21.87	24.80	57.26
T ₄	FYM	10 Days	1.70	3.90	15.13	23.57	44.30	4.72	4.90	20.07	22.87	52.55
T ₅	FYM	20 Days	1.70	3.87	14.93	22.43	42.93	4.70	4.70	20.00	22.80	52.20
T ₆	FYM	30 Days	1.20	1.90	12.83	16.27	32.20	2.22	2.83	14.30	16.30	35.66
T ₇	NC	10 Days	1.50	3.07	14.40	20.60	39.57	4.56	4.40	18.30	19.77	47.02
T ₈	NC	20 Days	1.40	2.33	14.03	19.67	37.43	2.28	3.10	16.03	19.00	40.41
T ₉	NC	30 Days	1.10	1.60	10.59	15.22	28.51	2.21	2.43	12.94	15.33	32.91
T ₁₀	VC	10 Days	1.90	4.93	17.77	27.00	51.60	4.91	5.83	22.17	26.70	59.61
T ₁₁	VC	20 Days	1.90	4.10	16.00	25.07	47.07	4.76	5.40	21.70	23.83	55.70
T ₁₂	VC	30 Days	1.20	2.27	13.53	17.17	34.17	2.26	2.93	15.90	17.20	38.29
		F- test	NS	S	S	S		S	S	S	S	
		S. Ed. (\pm)	-	0.63	0.21	0.59		0.43	0.43	1.79	2.94	
		C. D. (P = 0.05)	-	1.30	0.43	1.23		0.90	0.88	3.69	6.07	

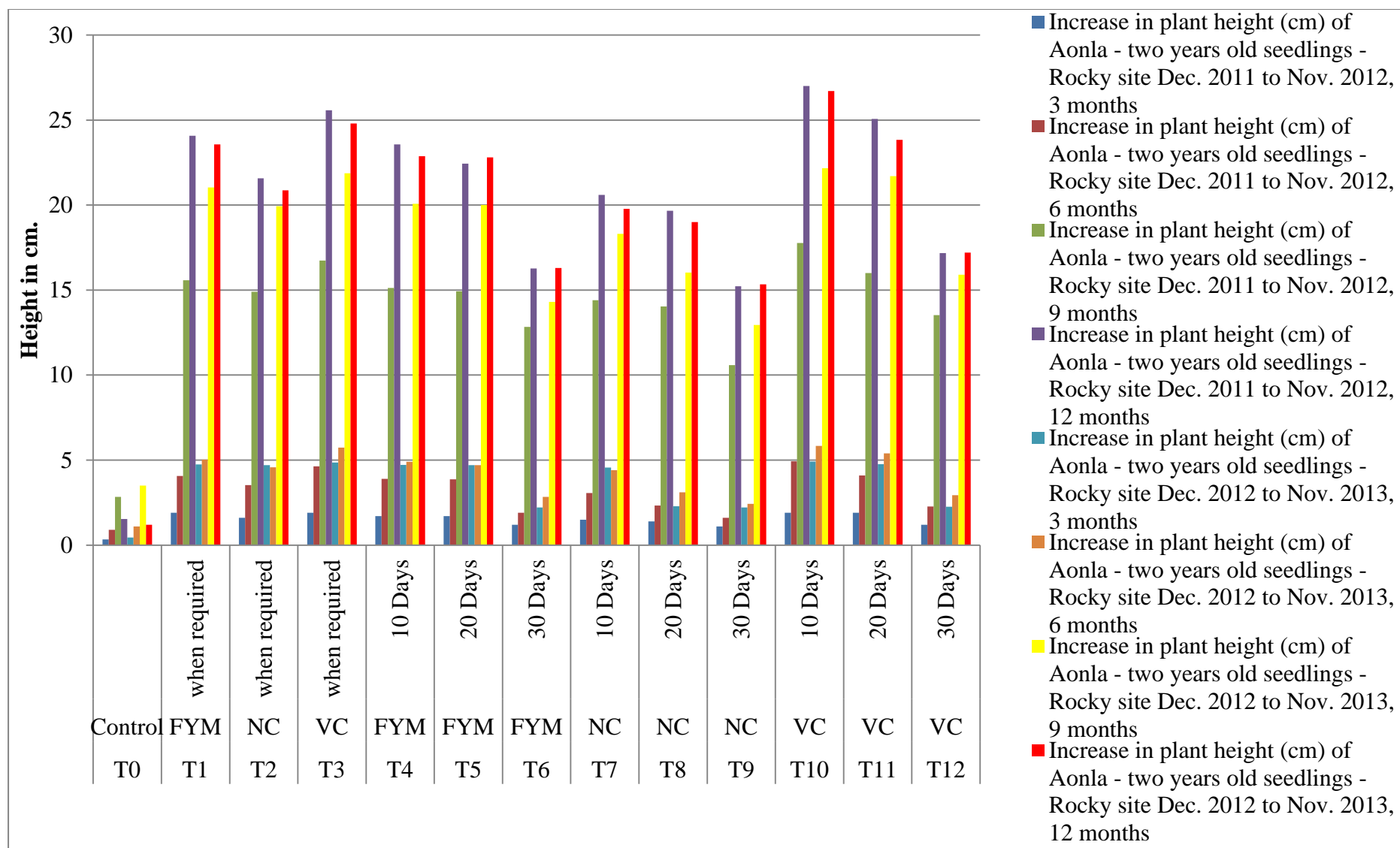


Fig. 4.9.1. Increase in plant height (cm) of two year old seedling of Aonla at Rocky site in December, 2011 to November, 2013.

4.9.2. Increase in Collar diameter (cm) of two year old seedling of *Emblica officinalis* (Aonla) at Rocky site in December, 2011 to November, 2012 and December, 2012 to November, 2013.

The Plant Collar diameter during first year (Table 4.9.2.) -

The results of the average Collar diameter after 3 month (0.27cm) was observed maximum in the treatment T_{10} and followed by T_3 (0.23cm), T_{11} (0.20cm) and T_4 (0.17cm), However, minimum increase Collar diameter was recorded in T_0 (0.08cm).

Collar diameter after 6 month (0.37cm) was observed maximum in T_{10} followed T_3 (0.37cm), T_{11} (0.33cm) and T_4 (0.30cm), However, minimum increase Collar diameter was recorded in T_0 (0.16cm).

Collar diameter after 9 month (1.70cm) was observed maximum in T_{10} and followed by T_3 (1.65cm), T_{11} (1.60cm) and T_4 (1.53cm). However, minimum increase Collar diameter was recorded in T_0 (0.37cm).

Collar diameter after 12 month (2.07cm) was observed maximum in T_{10} and followed by T_3 (1.77cm), T_{11} (1.53cm) and T_4 (1.30cm). However, minimum increase Collar diameter was recorded in T_0 (0.30cm). Other organic manure and irrigation schedule showed the significant differences in the plant collar diameter in all monthly treatment of first year.

The Plant Collar diameter during second year (Table 4.9.2.) -

The results of the average Collar diameter after 3 month (0.60cm) was observed maximum in the treatment T_{10} and followed by T_3 (0.60cm), T_{11} (0.50cm) and T_4 (0.40cm), However, minimum increase Collar diameter was recorded in T_0 (0.15cm).

Collar diameter after 6 month (2.10cm) was observed maximum in T_{10} and followed by T_3 (1.93cm), T_{11} (1.80cm) and T_4 (1.67cm), However, minimum increase Collar diameter was recorded in T_0 (0.16cm).

Collar diameter after 9 month (2.13cm) was observed maximum in T₁₀ and followed by T₃ (2.07cm), T₁₁ (1.83cm) and T₄ (1.73cm). However, minimum increase Collar diameter was recorded in T₀ (0.25cm).

Collar diameter after 12 month reported maximum (2.20cm) was observed maximum in T₁₀ and followed by T₃ (2.20cm), T₁₁ (2.10cm) and T₄ (1.73cm). However, minimum increase Collar diameter was recorded in T₀ (0.75cm). Other organic manure and irrigation schedule showed the significant differences in the plant collar diameter in all monthly treatment of second year.

Table 4.9.2. Increase in collar diameter (cm) of two years old seedlings of Aonla (*Emblica officinalis*) at Rocky site at different intervals (Year-wise)

Treatment No.	Treatment		Increase in collar diameter (cm) of Aonla - two years old seedlings - Rocky site									
			December, 2011 to November, 2012					December, 2012 to November, 2013				
			3 months	6 months	9 months	12 months	Total	3 months	6 months	9 months	12 months	Total
T ₀	Control		0.08	0.16	0.37	0.30	0.91	0.15	0.16	0.25	0.75	1.31
T ₁	FYM	When required	0.17	0.30	1.57	1.47	3.50	0.43	1.70	1.83	1.87	5.83
T ₂	NC	When required	0.13	0.27	1.47	1.10	2.97	0.33	1.20	1.60	1.57	4.70
T ₃	VC	When required	0.23	0.37	1.65	1.77	4.01	0.60	1.93	2.07	2.20	6.80
T ₄	FYM	10 Days	0.17	0.30	1.53	1.30	3.30	0.40	1.67	1.73	1.73	5.53
T ₅	FYM	20 Days	0.13	0.27	1.50	1.23	3.13	0.37	1.40	1.73	1.60	5.10
T ₆	FYM	30 Days	0.10	0.23	0.93	0.80	2.07	0.27	0.83	0.97	0.93	3.00
T ₇	NC	10 Days	0.10	0.23	1.43	1.03	2.80	0.33	1.13	1.43	1.37	4.27
T ₈	NC	20 Days	0.10	0.23	1.23	0.93	2.50	0.30	0.97	1.20	1.13	3.60
T ₉	NC	30 Days	0.10	0.17	0.93	0.53	1.73	0.26	0.63	0.73	0.90	2.52
T ₁₀	VC	10 Days	0.27	0.37	1.70	2.07	4.40	0.60	2.10	2.13	2.20	7.03
T ₁₁	VC	20 Days	0.20	0.33	1.60	1.53	3.67	0.50	1.80	1.83	2.10	6.23
T ₁₂	VC	30 Days	0.10	0.23	1.17	0.80	2.30	0.30	0.83	1.17	0.93	3.23
		F- test	S	S	S	S		S	S	S	S	
		S. Ed. (\pm)	0.01	0.01	0.03	0.02		0.04	0.08	0.06	0.48	
		C. D. (P = 0.05)	0.02	0.03	0.05	0.05		0.09	0.16	0.13	0.99	

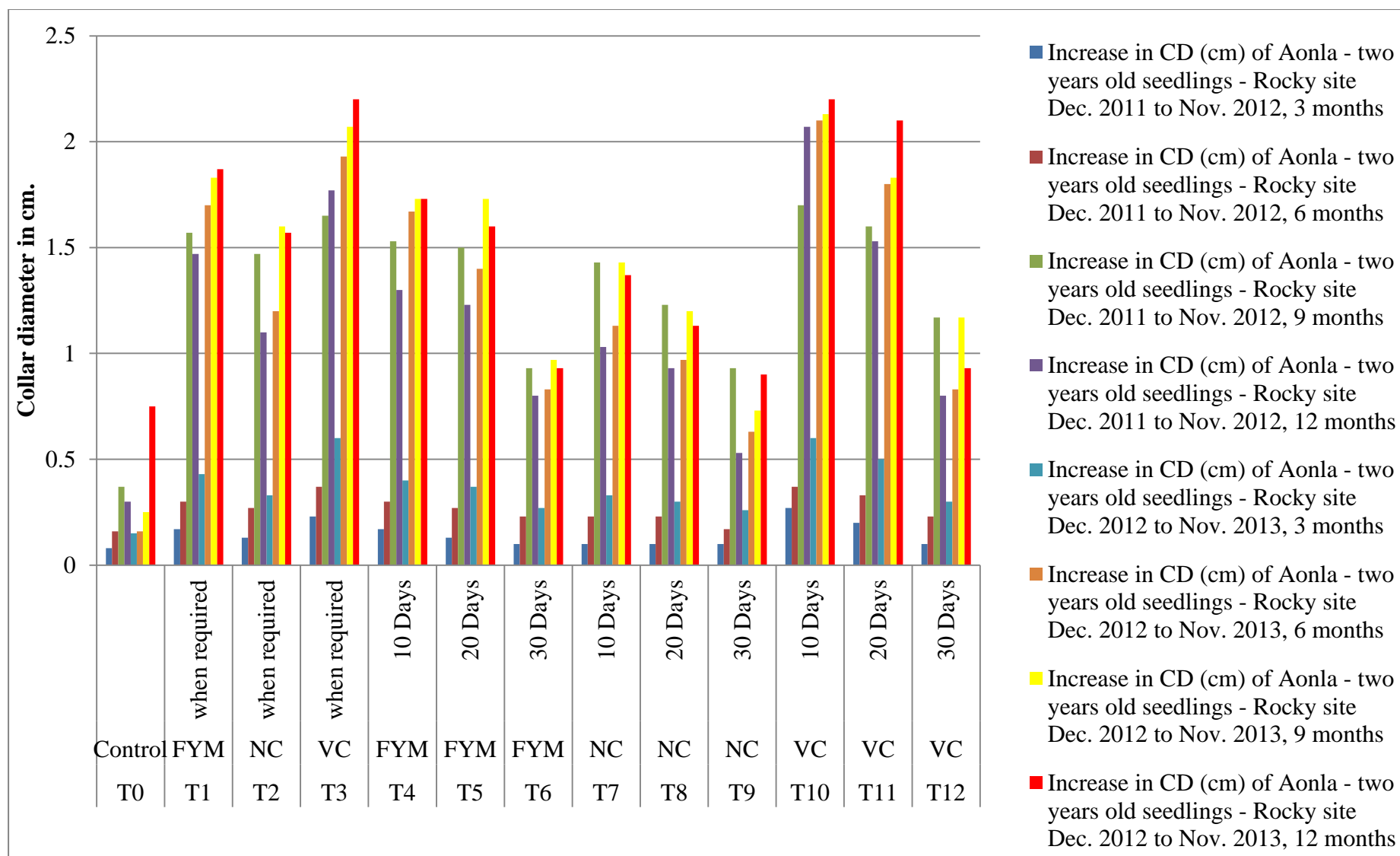


Fig. 4.9.2. Increase in Collar diameter (cm) of Two year old seedling of Aonla at Rocky site in December, 2011 to November, 2013.

4.9.3. Survival percentage of two year old seedling of *Emblica officinalis* (Aonla) at Rocky Sites at different intervals in December, 2011 to November, 2012 and December, 2012 to November, 2013.

The Plant Survival percentage during first year (Table 4.9.3.) -

The survivality in first year of 3, 6, 9 and 12 month reported Aonla seedlings grown at rocky sites with different intervals of irrigation schedule along with the applications of organic manures available or provide in a form of different treatment combinations.

The study clearly indicates non significant maximum survival percentage i.e. 100% was found in T₀, T₁, T₂, T₃, T₄, T₅, T₆, T₇, T₈, T₉, T₁₀, T₁₁ and T₁₂ due to good soil condition, nature of soil fertility availability essential minerals & nutrients, proper and good health condition of Aonla seedlings and its adaptability. Overall it is observed that treatment T₁₀ (vermicompost @ 10 days of irrigation schedule) with maximum survivality or survival % i.e. 100@ along with other attributes or observatory parameters would consider the best treatment combination.

The Plant Survival percentage during second year (Table 4.9.3.) -

The survivality in second year of 3 month reported Aonla seedlings grown at usar sites with different intervals of irrigation schedule along with the applications of organic manures available or provide in a form of different treatment combinations.

The study clearly indicates non significant maximum survival percentage i.e. 100% was found in T₁, T₂, T₃, T₄, T₅, T₆, T₇, T₈, T₁₀, T₁₁ and T₁₂ treatments.

The survivality in second year of 6, 9 and 12 month reported Aonla seedlings grown at rocky sites with different intervals of irrigation schedule along with the applications of organic manures available or provide in a form of different treatment combinations.

The study clearly indicates non significant maximum survival percentage i.e. 100% was found in T₁, T₂, T₃, T₄, T₅, T₆, T₇, T₈, T₁₀, T₁₁ and T₁₂ due to good soil condition, nature of soil fertility availability essential minerals & nutrients, proper and good health condition of Aonla seedlings and its adaptability followed with T₉ 66.67% and the minimum survival percentage (33.33) was found in T₀. Overall it is observed

that treatment T_{10} (vermicompost @ 10 days of irrigation schedule) with maximum survival or survival % i.e. 100% along with other attributes or observatory parameters would consider the best treatment combination.

Table 4.9.3. Survival percentage of two years old seedlings of Aonla (*Emblica officinalis*) at Rocky site at different intervals (Year-wise)

Treatment No.	Treatment		Survival percentage of Aonla - two years old seedlings - Rocky site									
			December, 2011 to November, 2012					December, 2012 to November, 2013				
			3 months	6 months	9 months	12 months	Total	3 months	6 months	9 months	12 months	Total
T ₀	Control		100.00	100.00	100.00	100.00	100.00	66.67	33.33	33.33	33.33	33.33
T ₁	FYM	When required	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₂	NC	When required	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₃	VC	When required	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₄	FYM	10 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₅	FYM	20 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₆	FYM	30 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₇	NC	10 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₈	NC	20 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₉	NC	30 Days	100.00	100.00	100.00	100.00	100.00	66.67	66.67	66.67	66.67	66.67
T ₁₀	VC	10 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₁₁	VC	20 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₁₂	VC	30 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
		F- test	NS	NS	NS	NS		NS	S	S	S	
		S. Ed. (\pm)	-	-	-	-		-	18.10	18.10	18.10	
		C. D. (P = 0.05)	-	-	-	-		-	37.36	37.36	37.36	

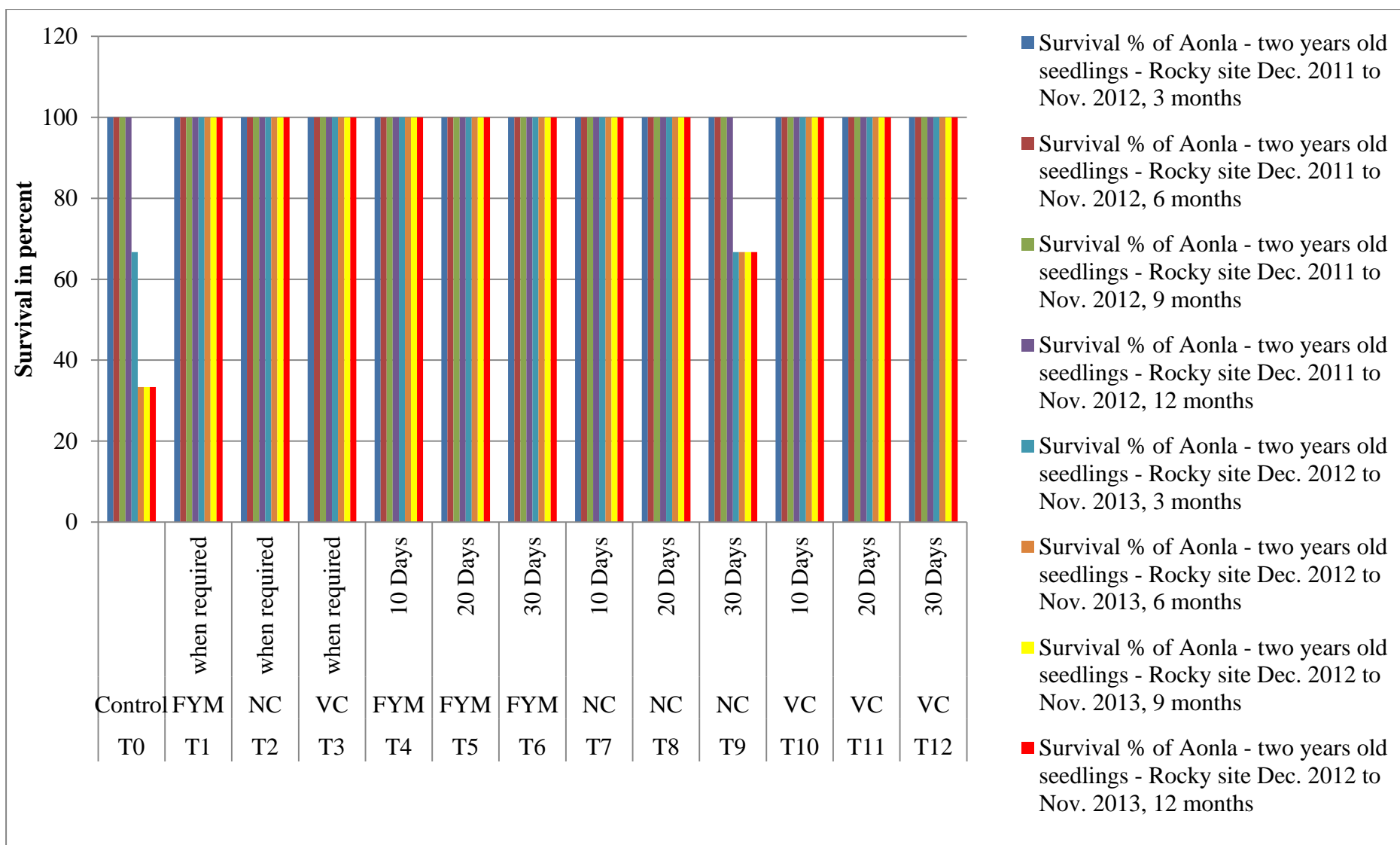


Fig. 4.9.3. Survival percentage of Two year old seedling of Aonla at Rocky site in December, 2011 to November, 2013.

4.10.1. Increase in plant height (cm) of six month old seedling plantation of *Carissa carandas* (Karondha) at Usar site in December, 2011 to November, 2012 and December, 2012 to November, 2013.

The Plant height during first year (Table 4.10.1.) -

The results of the average plant height after 3 month (0.55cm) was observed maximum in the treatment T_{10} and followed by T_3 (0.53cm), T_{11} (0.51cm) and T_4 (0.51cm), However, minimum was recorded in T_0 (0.40cm).

Plant height after 6 month (1.53cm) was observed maximum in T_{10} followed by, T_3 (1.30cm), T_{11} (1.30cm), T_4 (1.27cm) and T_1 (1.18cm). However, minimum was recorded in T_0 (0.55cm).

Plant height after 9 month (4.57cm) was observed maximum in T_{10} and followed by T_{11} (4.23cm) T_3 (4.23cm), T_1 (4.20cm) and T_4 (4.20cm). However, minimum was recorded in T_0 (3.00cm).

Plant height after 12 month (3.20cm) was observed maximum in T_{10} and followed by T_1 (3.03cm), T_3 (3.10cm), T_4 (3.10cm) and T_{11} (3.10cm). However, minimum was recorded in T_0 (1.60cm). Other organic manure and irrigation schedule showed the significant difference in the plant height in all monthly treatment of first year.

The Plant height during second year (Table 4.10.1.) -

Plant height after 3 month (0.70cm) was observed maximum in the treatment T_{10} and followed by T_3 (0.70cm), T_{11} (0.67cm) and T_4 (0.63cm), However, minimum was recorded in T_0 (0.47cm).

Plant height after 6 month (2.73cm) was observed maximum in T_{10} and followed by T_3 (2.67cm), T_4 (2.60cm), T_{11} (2.60cm) and T_1 (2.53cm). However, minimum was recorded in T_0 (1.30cm).

Plant height after 9 month (5.77cm) was observed maximum in T_{10} and followed by T_3 (5.10cm), T_{11} (5.10cm), T_1 (5.07cm) and T_4 (5.07cm). However, minimum was recorded in T_0 (3.70cm).

Plant height after 12 month (4.37cm) was observed maximum in T_{10} and followed by T_{11} (4.10cm), T_3 (4.10cm) and T_4 (4.09cm). However, minimum was

recorded in T_0 (2.47cm). Other organic manure and irrigation schedule showed the significant difference in the plant height in all monthly treatment of second year.

Table 4.10.1. Increase in plant height (cm) of six months old seedlings of Karondha (*Carissa carandas*) at Usar site at different intervals (Year-wise)

Treatment No.	Treatment		Increase in plant height (cm) of Karondha - 6 months old seedlings - Usar site									
	Organic manure	Irrigation schedule	December, 2011 to November, 2012					December, 2012 to November, 2013				
			3 months	6 months	9 months	12 months	Total	3 months	6 months	9 months	12 months	Total
T ₀	Control		0.40	0.55	3.00	1.60	5.55	0.47	1.30	3.70	2.47	7.94
T ₁	FYM	When required	0.48	1.18	4.20	3.03	8.89	0.63	2.53	5.07	4.05	12.28
T ₂	NC	When required	0.48	1.13	3.87	2.70	8.17	0.63	1.83	4.40	3.32	10.18
T ₃	VC	When required	0.53	1.30	4.23	3.10	9.17	0.70	2.67	5.10	4.10	12.57
T ₄	FYM	10 Days	0.51	1.27	4.20	3.10	9.08	0.63	2.60	5.07	4.09	12.39
T ₅	FYM	20 Days	0.48	1.18	4.20	2.80	8.66	0.63	2.17	5.07	3.66	11.53
T ₆	FYM	30 Days	0.40	0.55	3.00	1.60	5.55	0.47	1.30	3.70	2.47	7.94
T ₇	NC	10 Days	0.45	1.00	3.87	2.63	7.95	0.63	1.77	4.40	3.23	10.03
T ₈	NC	20 Days	0.44	0.97	3.77	2.53	7.71	0.57	1.62	4.40	2.81	9.40
T ₉	NC	30 Days	0.42	0.63	3.30	2.40	6.75	0.47	1.44	3.70	2.72	8.32
T ₁₀	VC	10 Days	0.55	1.53	4.57	3.20	9.85	0.70	2.73	5.77	4.37	13.57
T ₁₁	VC	20 Days	0.51	1.30	4.23	3.10	9.14	0.67	2.60	5.10	4.10	12.47
T ₁₂	VC	30 Days	0.44	0.72	3.67	2.47	7.29	0.50	1.52	4.40	2.79	9.21
		F- test	S	S	S	S		S	S	S	S	
		S. Ed. (\pm)	0.07	0.11	0.89	0.50		0.10	0.28	0.90	0.66	
		C. D. (P = 0.05)	0.15	0.22	1.83	1.02		0.21	0.58	1.86	1.36	

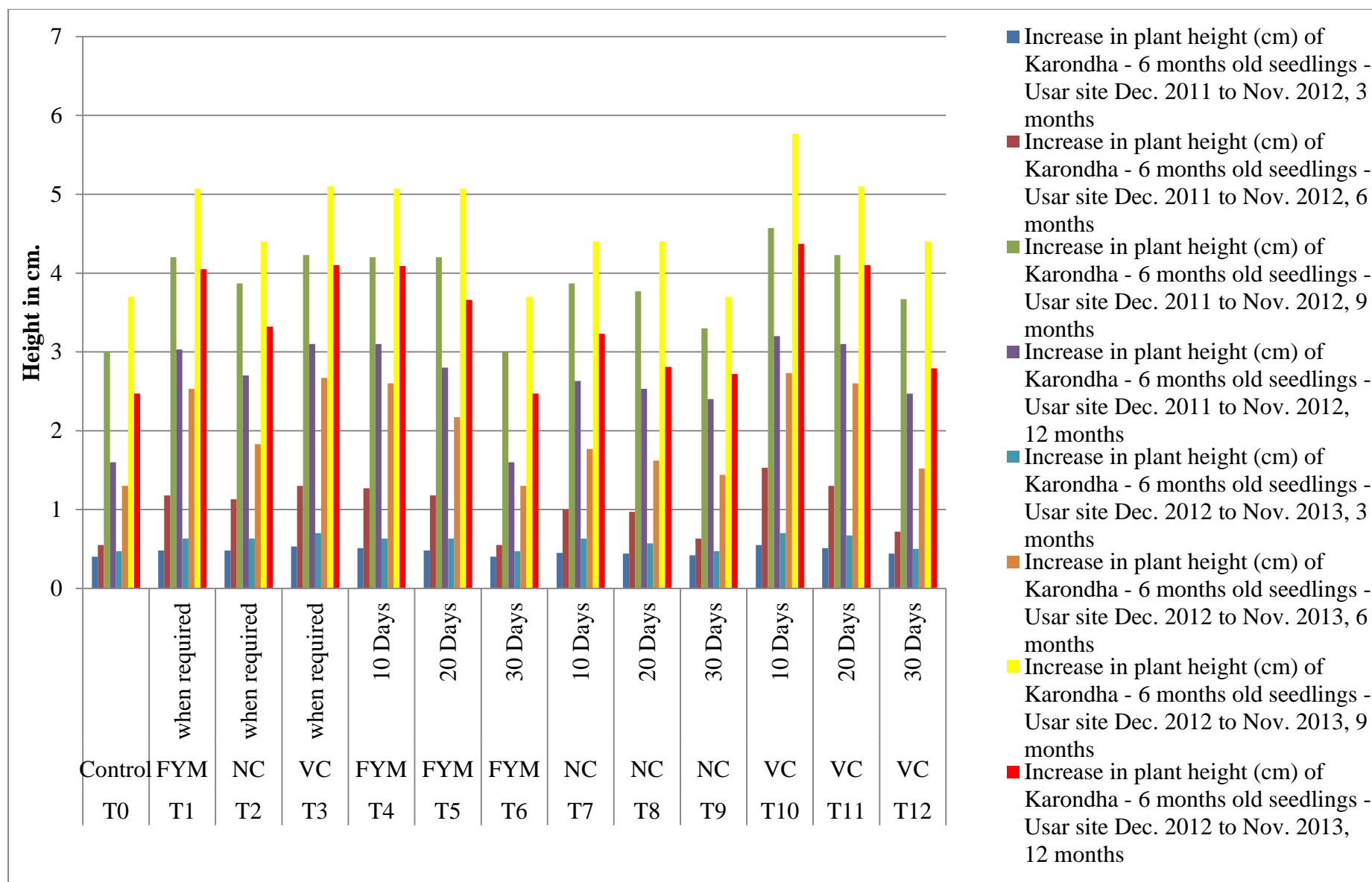


Fig. 4.10.1. Increase in plant height (cm) of six months old seedlings of Karondha at Usar sites in December, 2011 to November, 2013.

4.10.2. Increase in Collar diameter (cm) of six month old seedling of *Carissa carandas* (Karondha) at Usar site in December, 2011 to November, 2012 and December, 2012 to November, 2013.

The Plant Collar diameter during first year (Table 4.10.2.) -

The results of the average Collar diameter after 3 month (0.20cm) was observed maximum in the treatment T₁₀ and followed by T₃ (0.20cm), T₁₁ (0.20cm) and T₄ (0.17cm) , However, minimum increase Collar diameter was recorded in T₀ (0.10cm).

Collar diameter after 6 month increase Collar diameter (0.30cm) was observed maximum in T₁₀ and followed by T₃ (0.23cm), T₁₁ (0.23cm), T₄ (0.23cm). However, minimum increase Collar diameter was recorded in T₀ (0.13cm).

Collar diameter after 9 month increase Collar diameter (0.27cm) was observed maximum in T₁₀ and followed by T₃ (0.27cm), T₁₁ (0.27cm), T₁ (0.27cm) and T₄ (0.27cm). However, minimum increase Collar diameter was recorded in T₀ (0.23cm).

Collar diameter after 12 month increase Collar diameter (0.43cm) was observed maximum in T₁₀ and followed by T₃ (0.39cm), T₁₁ (0.38cm) and T₄ (0.37cm). However, minimum increase Collar diameter was recorded in T₀ (0.19cm). Other organic manure and irrigation schedule showed the significant differences in the plant collar diameter in all monthly treatment of first year.

The Plant Collar diameter during second year (Table 4.10.2.) -

The results of the average Collar diameter after 3 month (0.30cm) was observed maximum in the treatment T₁₀ and followed by T₃ (0.30cm) , T₁₁ (0.30cm) and T₄ (0.30cm). However, minimum increase Collar diameter was recorded in T₀ (0.10cm).

Collar diameter after 6 month (0.30cm) was observed maximum in T₁₀ and followed by T₃ (0.30cm), T₁₁ (0.27cm), T₄ (0.27cm). However, minimum increase Collar diameter was recorded in T₀ (0.10cm).

Collar diameter after 9 month (0.33cm) was observed maximum in T₁₀ and followed by T₃ (0.30cm), T₁₁ (0.30cm), T₁ (0.30cm) and T₄ (0.30cm). However, minimum increase Collar diameter was recorded in T₀ (0.16cm).

Collar diameter after 12 month (0.30cm) was observed maximum in T₁₀ and followed by T₁₁ (0.29cm), T₃ (0.30cm) and T₄ (0.29cm). However, minimum increase Collar diameter was recorded in T₀ (0.23cm). Other organic manure and irrigation schedule showed the significant differences in the plant collar diameter in all monthly treatment of second year.

Table 4.10.2. Increase in collar diameter (cm) of six months old seedlings of Karondha (*Carissa carandas*) at Usar site at different intervals (Year-wise)

Treatment No.	Treatment		Increase in collar diameter (cm) of Karondha - 6 months old seedlings - Usar site									
	Organic manure	Irrigation schedule	December, 2011 to November, 2012					December, 2012 to November, 2013				
			3 months	6 months	9 months	12 months	Total	3 months	6 months	9 months	12 months	Total
T ₀	Control		0.10	0.13	0.23	0.19	0.65	0.10	0.10	0.16	0.23	0.59
T ₁	FYM	When required	0.17	0.23	0.27	0.37	1.03	0.30	0.27	0.30	0.27	1.14
T ₂	NC	When required	0.17	0.20	0.23	0.31	0.91	0.30	0.27	0.27	0.23	1.07
T ₃	VC	When required	0.20	0.23	0.27	0.39	1.09	0.30	0.30	0.30	0.30	1.20
T ₄	FYM	10 Days	0.17	0.23	0.27	0.37	1.04	0.30	0.27	0.30	0.29	1.16
T ₅	FYM	20 Days	0.17	0.20	0.23	0.37	0.97	0.30	0.27	0.27	0.25	1.08
T ₆	FYM	30 Days	0.10	0.13	0.23	0.19	0.66	0.10	0.13	0.21	0.23	0.68
T ₇	NC	10 Days	0.15	0.20	0.23	0.27	0.86	0.27	0.23	0.23	0.23	0.97
T ₈	NC	20 Days	0.13	0.17	0.23	0.22	0.76	0.23	0.23	0.23	0.23	0.93
T ₉	NC	30 Days	0.10	0.13	0.23	0.20	0.67	0.10	0.13	0.21	0.23	0.68
T ₁₀	VC	10 Days	0.20	0.30	0.27	0.43	1.20	0.30	0.30	0.33	0.30	1.23
T ₁₁	VC	20 Days	0.20	0.23	0.27	0.38	1.08	0.30	0.27	0.30	0.29	1.16
T ₁₂	VC	30 Days	0.10	0.13	0.23	0.22	0.69	0.13	0.17	0.23	0.23	0.77
		F- test	S	S	S	S		S	S	S	S	
		S. Ed. (±)	0.02	0.03	0.04	0.09		0.04	0.03	0.03	0.04	
		C. D. (P = 0.05)	0.05	0.06	0.07	0.18		0.08	0.07	0.06	0.08	

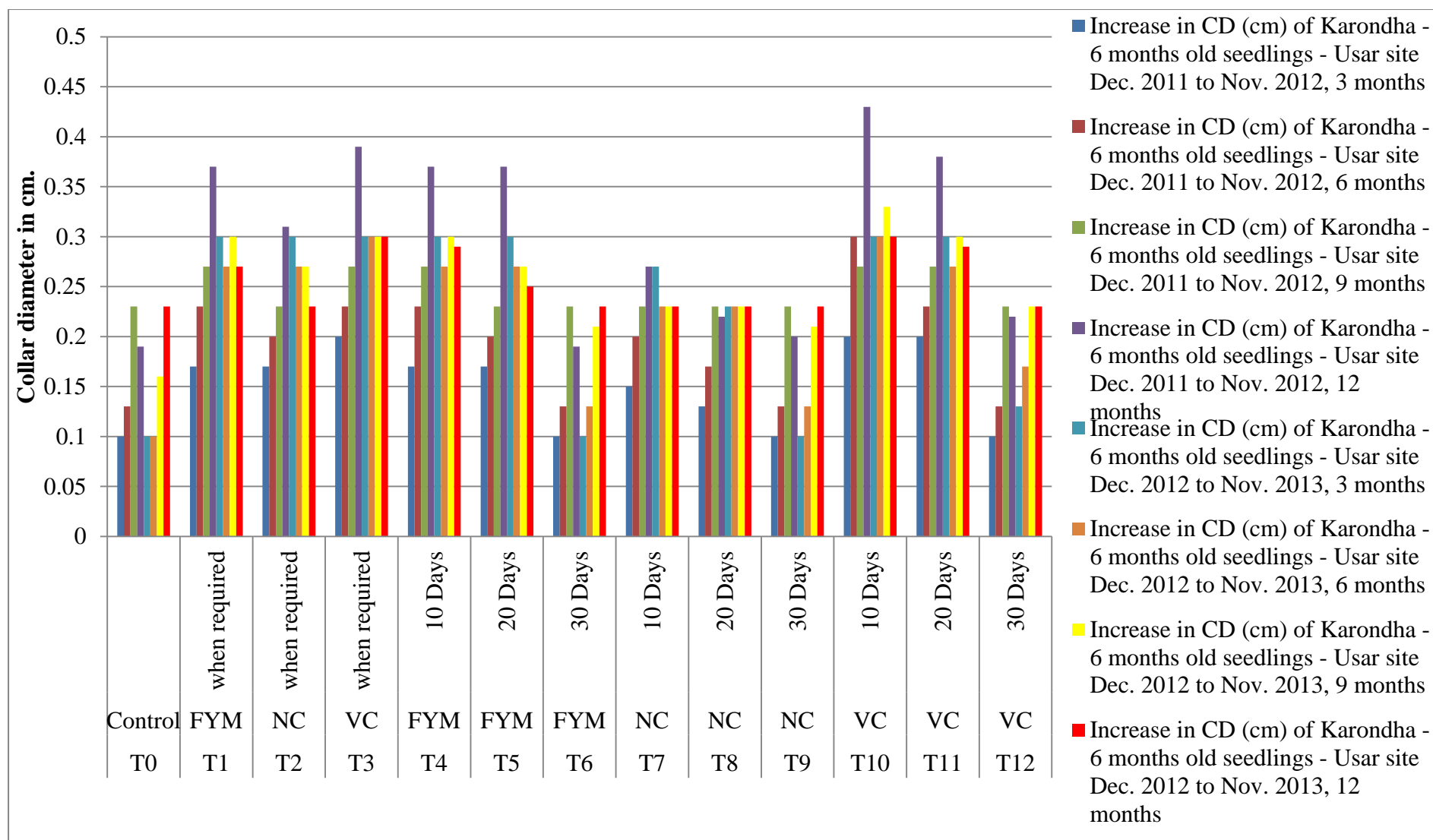


Fig. 4.10.2. Increase in Collar diameter (cm) of six month old seedling of Karondha at Usar sites in December, 2011 to November, 2013.

4.10.3. Survival percentage of *Carissa carandas* (Karondha) - 6 months old seedling at Usar site at different intervals in December, 2011 to November, 2012 December, 2012 to November, 2013.

The Plant Survival percentage during first year (Table 4.10.3.) -

The survivability in first year of 3 month reported Karondha seedlings grown at Usar sites with different intervals of irrigation schedule along with the applications of organic manures available or provide in a form of different treatment combinations.

The study clearly indicates significant maximum survival percentage i.e.100% was found in T₁, T₂, T₃, T₄ T₅, T₇, T₈, T₉, T₁₀, T₁₁ and T₁₂ due to good soil condition, nature of soil fertility availability essential minerals & nutrients, proper and good health condition of karondha seedlings and its adaptability. This followed T₆with 66.67 percent and treatment T₀ (control) which shows (33.33%) minimum survival percentage of karondha seedlings because of some deficiencies are found present in usar site or decrease in physical nature of soil.

The survivability in first year of 6, 9 and 12 month reported Karondha seedlings grown at Usar sites with different intervals of irrigation schedule along with the applications of organic manures available or provide in a form of different treatment combinations.

The study clearly indicates non significant maximum survival percentage i.e. 100% was found in T₁, T₂, T₃, T₄ T₅, T₇, T₈, T₁₀, T₁₁ and T₁₂ due to good soil condition, nature of soil fertility availability essential minerals & nutrients, proper and good health condition of karondha seedlings and its adaptability. This followed T₆ and T₉with 66.67 percent and treatment T₀ (control) which shows (33.33%) minimum survival percentage of karondha seedlings because of some deficiencies are found present in usar site or decrease in physical nature of soil. Overall it is observed that treatment T₁₀ (vermicompost @ 10 days of irrigation schedule) with maximum survivability or survival % i.e. 100@ along with other attributes or observatory parameters would consider the best treatment combination.

The Plant Survival percentage during second year (Table 4.10.3.) -

The survivality in second year of 3, 6, 9 and 12 month reported Karondha seedlings grown at usar sites with different intervals of irrigation schedule along with the applications of organic manures available or provide in a form of different treatment combinations.

The study clearly indicates non significant maximum survival percentage i.e. 100% was found in T₁, T₂, T₃, T₄ T₅, T₇, T₈, T₁₀, T₁₁ and T₁₂ due to good soil condition, nature of soil fertility availability essential minerals & nutrients, proper and good health condition of karondha seedlings and its adaptability. This followed T₆ and T₉ with 66.67 percent and treatment T₀ (control) which shows (33.33%) minimum survival percentage of karondha seedlings because of some deficiencies are found present in usar site or decrease in physical nature of soil. Overall it is observed that treatment T₁₀ (vermicompost @ 10 days of irrigation schedule) with maximum survivality or survival % i.e. 100@ along with other attributes or observatory parameters would consider the best treatment combination.

Table 4.10.3. Survival percentage of six months old seedlings of Karondha (*Carissa carandas*) at Usar site at different intervals (Year-wise)

Treatment No.	Treatment		Survival percentage of Karondha - 6 months old seedlings - Usar site									
			December, 2011 to November, 2012					December, 2012 to November, 2013				
	Organic manure	Irrigation schedule	3 months	6 months	9 months	12 months	Total	3 months	6 months	9 months	12 months	Total
T ₀	Control		33.33	33.33	33.33	33.33	33.33	33.33	33.33	33.33	33.33	33.33
T ₁	FYM	When required	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₂	NC	When required	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₃	VC	When required	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₄	FYM	10 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₅	FYM	20 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₆	FYM	30 Days	66.67	66.67	66.67	66.67	66.67	66.67	66.67	66.67	66.67	66.67
T ₇	NC	10 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₈	NC	20 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₉	NC	30 Days	100.00	66.67	66.67	66.67	66.67	66.67	66.67	66.67	66.67	66.67
T ₁₀	VC	10 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₁₁	VC	20 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₁₂	VC	30 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
		F- test	S	NS	NS	NS		NS	NS	NS	NS	
		S. Ed. (\pm)	18.10	-	-	-		-	-	-	-	
		C. D. (P = 0.05)	37.36	-	-	-		-	-	-	-	

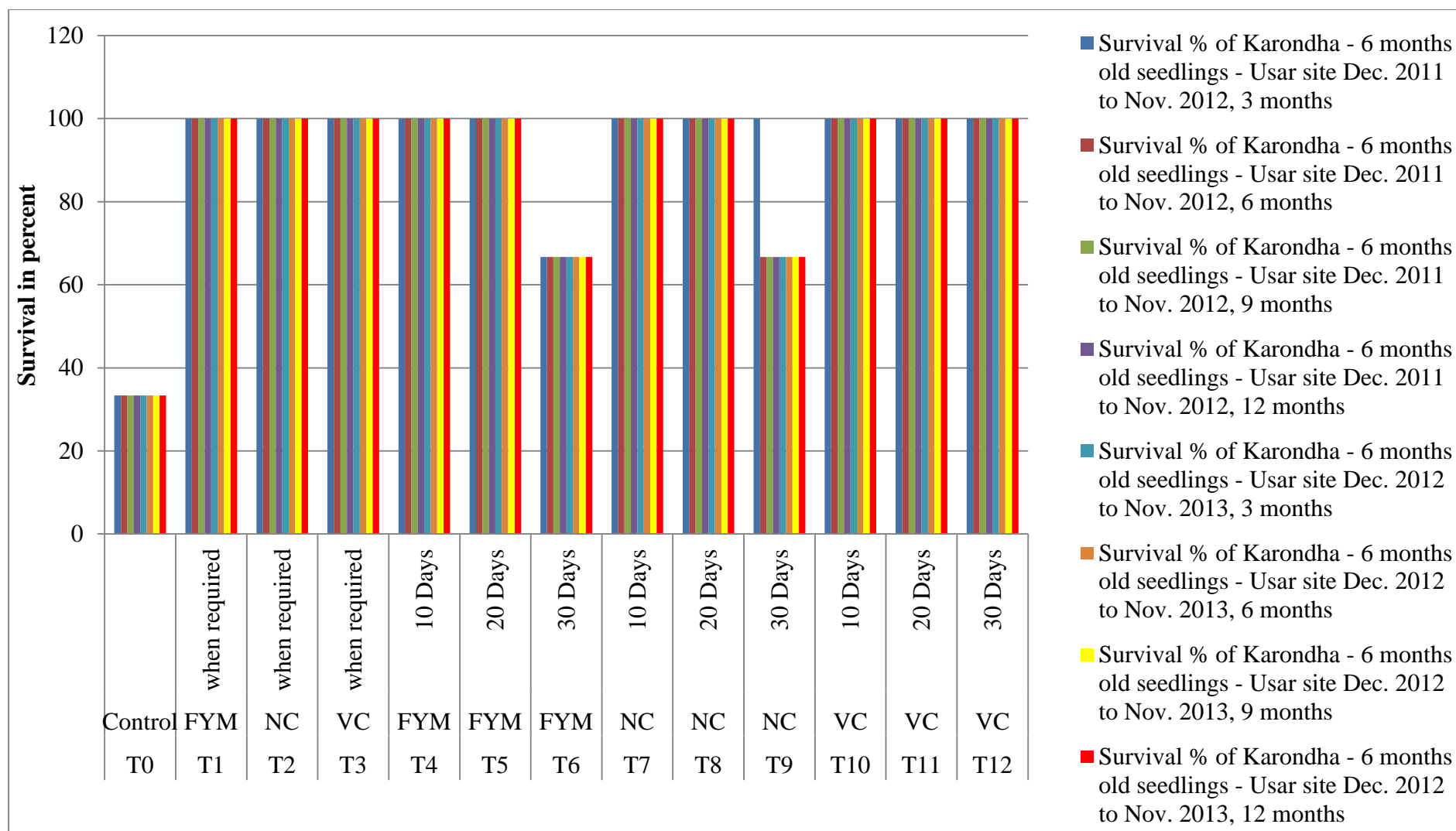


Fig. 4.10.3. Survival percentage of six month old seedling of Karondha at Usar sites in December, 2011 to November, 2013.

4.11. One year old seedling plantation of *Carissa carandas* (Karondha) at Usar site:

4.11.1. Increase in plant height (cm) of one year old seedling of *Carissa carandas* (Karondha) at Usar site in December, 2011 to November, 2012 and December, 2012 to November, 2013.

The Plant height during first year (Table 4.11.1.) -

The results of the average plant height after 3 month (0.73cm) was observed maximum in the treatment T₁₀ and followed by T₃ (0.68cm), T₁₁ (0.66cm) and T₄ (0.64cm), However, minimum was recorded in T₀ (0.43cm).

Plant height after 6 month (1.61cm) was observed maximum in T₁₀ and followed by T₃ (1.45cm), T₁₁ (1.28cm), and T₄ (1.18cm). However, minimum was recorded in T₀ (0.67cm).

Plant height after 9 month (6.93cm) was observed maximum in T₁₀ and followed by T₃ (6.60cm), T₁₁ (6.07cm), T₄ (6.00cm) and T₁ (5.73cm). However, minimum was recorded in T₀ (3.47cm).

Plant height after 12 month (4.53cm) was observed maximum in T₁₀ and followed by T₃ (3.87cm), T₁₁ (3.67cm) and T₄ (3.57cm). However, minimum was recorded in T₀ (2.53cm). Other organic manure and irrigation schedule showed the significant difference in the plant height in all monthly treatment of first year.

The Plant height during second year (Table 4.11.1.) -

Plant height after 3 month (0.70cm) was observed maximum in the treatment T₁₀ and followed by T₃ (0.67cm), T₁₁ (0.63cm) and T₄ (0.63cm). However, minimum was recorded in T₀ (0.40cm).

Plant height after 6 month (4.03cm) was observed maximum in T₁₀ and followed by T₃ (3.37cm), T₁₁ (3.00cm) and T₄ (2.97cm). However, minimum was recorded in T₀ (2.28cm).

Plant height after 9 month (9.37cm) was observed maximum in T₁₀ and followed by T₃ (8.87cm), T₁₁ (7.93cm), T₄ (7.80cm) and T₁ (7.67cm). However, minimum was recorded in T₀ (5.20cm).

Plant height after 12 month (6.04cm) was observed maximum in T₁₀ and followed by T₃ (5.40cm), T₁₁ (5.06cm) and T₄ (5.03cm). However, minimum was recorded in T₀ (3.60cm). Other organic manure and irrigation schedule showed the significant difference in the plant height in all monthly treatment of second year.

Table 4.11.1 Increase in plant height (cm) of one year old seedlings of Karondha (*Carissa carandas*) at Usar site at different intervals (Year-wise)

Treatment No.	Treatment		Increase in plant height (cm) of Karondha - one year old seedlings - Usar site									
	Organic manure	Irrigation schedule	December, 2011 to November, 2012					December, 2012 to November, 2013				
			3 months	6 months	9 months	12 months	Total	3 months	6 months	9 months	12 months	Total
T ₀	Control		0.43	0.67	3.47	2.53	7.10	0.40	2.28	5.20	3.60	11.48
T ₁	FYM	When required	0.61	1.09	5.73	3.43	10.87	0.63	2.93	7.67	5.01	16.24
T ₂	NC	When required	0.60	1.03	5.50	3.40	10.53	0.63	2.90	7.47	4.68	15.68
T ₃	VC	When required	0.68	1.45	6.60	3.87	12.60	0.67	3.37	8.87	5.40	18.30
T ₄	FYM	10 Days	0.64	1.18	6.00	3.57	11.39	0.63	2.97	7.80	5.03	16.43
T ₅	FYM	20 Days	0.61	1.09	5.63	3.40	10.73	0.63	2.90	7.47	4.73	15.73
T ₆	FYM	30 Days	0.43	0.70	3.47	2.53	7.13	0.40	2.28	5.20	3.60	11.48
T ₇	NC	10 Days	0.59	0.97	5.00	3.37	9.93	0.60	2.87	6.57	4.67	14.71
T ₈	NC	20 Days	0.57	0.88	4.67	3.27	9.38	0.60	2.70	6.30	4.54	14.14
T ₉	NC	30 Days	0.49	0.76	3.83	2.67	7.75	0.40	2.36	5.93	3.70	12.39
T ₁₀	VC	10 Days	0.73	1.61	6.93	4.53	13.80	0.70	4.03	9.37	6.04	20.14
T ₁₁	VC	20 Days	0.66	1.28	6.07	3.67	11.67	0.63	3.00	7.93	5.06	16.63
T ₁₂	VC	30 Days	0.55	0.87	4.17	2.97	8.56	0.40	2.47	6.23	4.31	13.41
		F- test	S	S	S	S		S	S	S	S	
		S. Ed. (\pm)	0.02	0.04	0.83	0.65		0.10	0.50	1.30	0.95	
		C. D. (P = 0.05)	0.03	0.08	1.70	1.34		0.20	1.02	2.68	1.96	

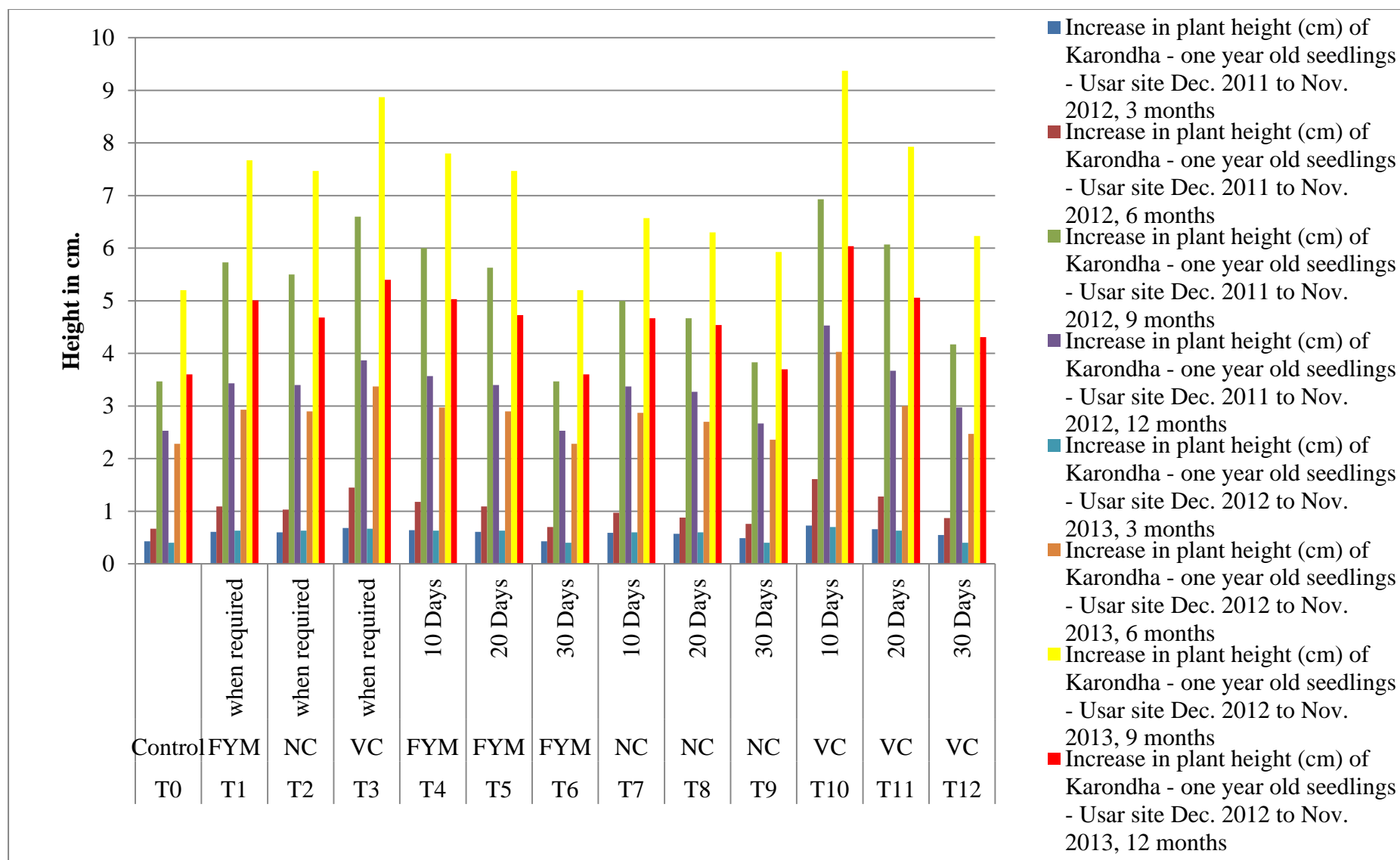


Fig. 4.11.1. Increase in plant height (cm) of one year old seedlings of Karondha at Usar sites in December, 2011 to November, 2013

4.11.2. Increase in Collar diameter (cm) of one year old seedling of *Carissa carandas* (Karondha) at Usar site in December, 2011 to November, 2012 and December, 2012 to November, 2013.

The Plant Collar diameter during first year (Table 4.11.2.) -

The results of the average Collar diameter after 3 month (0.30cm) was observed maximum in the treatment T₁₀ and followed by T₃ (0.27cm), T₁₁ (0.27cm) and T₄ (0.23cm), However, minimum increase Collar diameter was recorded in T₀ (0.10cm).

Collar diameter after 6 month (0.27cm) was observed maximum in T₁₀ and followed by T₃ (0.27cm), T₁₁ (0.27cm), T₄ (0.23cm). However, minimum increase Collar diameter was recorded in T₀ (0.13cm).

Collar diameter after 9 month (0.50cm) was observed maximum in T₁₀ and followed by T₃ (0.50cm), T₁₁ (0.50cm), T₁ (0.47cm) and T₄ (0.47cm). However, minimum increase Collar diameter was recorded in T₀ (0.23cm).

Collar diameter after 12 month (0.65cm) was observed maximum in T₁₀ and followed by T₃ (0.62cm), T₁₁ (0.61cm) and T₄ (0.61cm). However, minimum increase Collar diameter was recorded in T₀ (0.14cm). Other organic manure and irrigation schedule showed the significant differences in the plant collar diameter in all monthly treatment of the first year.

The Plant Collar diameter during second year (Table 4.11.2.) -

The results of the average Collar diameter after 3 month (0.40cm) was observed maximum in the treatment T₁₀ and followed by T₃ (0.50cm), T₁₁ (0.50cm) and T₄ (0.47cm), However, minimum increase Collar diameter was recorded in T₀ (0.10cm).

Collar diameter after 6 month (0.30cm) was observed maximum in T₁₀ and followed by T₃ (0.62cm), T₁₁ (0.61cm), T₄ (0.61cm). However, minimum increase Collar diameter was recorded in T₀ (0.13cm).

Collar diameter after 9 month (0.50cm) was observed maximum in T₁₀ and followed by T₃ (0.50cm), T₁₁ (0.50cm), T₁ (0.50cm) and T₄ (0.50cm). However, minimum increase collar diameter was recorded in T₀ (0.23cm).

Collar diameter after 12 month (0.39cm) was observed maximum in T₁₀ and followed by T₃ (0.39cm), T₁₁ (0.38cm) and T₄ (0.38cm). However, minimum increase Collar diameter

was recorded in T₀ (0.26cm). Other organic manure and irrigation schedule showed the significant differences in the plant collar diameter in all monthly treatment of the second year.

Table 4.11.2. Increase in collar diameter (cm) of one year old seedlings of Karondha (*Carissa carandas*) at Usar site at different intervals (Year-wise)

Treatment No.	Treatment		Increase in collar diameter (cm) of Karondha - one year old seedlings - Usar site									
	Organic manure	Irrigation schedule	December, 2011 to November, 2012					December, 2012 to November, 2013				
			3 months	6 months	9 months	12 months	Total	3 months	6 months	9 months	12 months	Total
T ₀	Control		0.10	0.13	0.23	0.14	0.60	0.10	0.13	0.23	0.26	0.73
T ₁	FYM	When required	0.17	0.23	0.47	0.58	1.44	0.37	0.27	0.50	0.38	1.51
T ₂	NC	When required	0.13	0.20	0.47	0.49	1.29	0.33	0.27	0.43	0.37	1.40
T ₃	VC	When required	0.27	0.27	0.50	0.62	1.66	0.40	0.30	0.50	0.39	1.59
T ₄	FYM	10 Days	0.23	0.23	0.47	0.61	1.54	0.40	0.30	0.50	0.38	1.58
T ₅	FYM	20 Days	0.16	0.23	0.47	0.50	1.36	0.33	0.27	0.47	0.38	1.45
T ₆	FYM	30 Days	0.10	0.13	0.25	0.15	0.63	0.10	0.13	0.23	0.26	0.73
T ₇	NC	10 Days	0.13	0.17	0.37	0.48	1.15	0.33	0.27	0.40	0.36	1.36
T ₈	NC	20 Days	0.10	0.17	0.37	0.38	1.01	0.30	0.27	0.30	0.35	1.21
T ₉	NC	30 Days	0.10	0.13	0.30	0.28	0.82	0.13	0.17	0.30	0.28	0.88
T ₁₀	VC	10 Days	0.30	0.27	0.50	0.65	1.72	0.40	0.30	0.50	0.39	1.59
T ₁₁	VC	20 Days	0.27	0.27	0.50	0.61	1.64	0.40	0.30	0.50	0.38	1.58
T ₁₂	VC	30 Days	0.10	0.17	0.37	0.35	0.98	0.27	0.17	0.30	0.32	1.06
		F- test	S	S	S	S		S	S	S	S	
		S. Ed. (\pm)	0.02	0.02	0.03	0.08		0.04	0.04	0.04	0.04	
		C. D. (P = 0.05)	0.05	0.05	0.06	0.16		0.09	0.09	0.07	0.08	

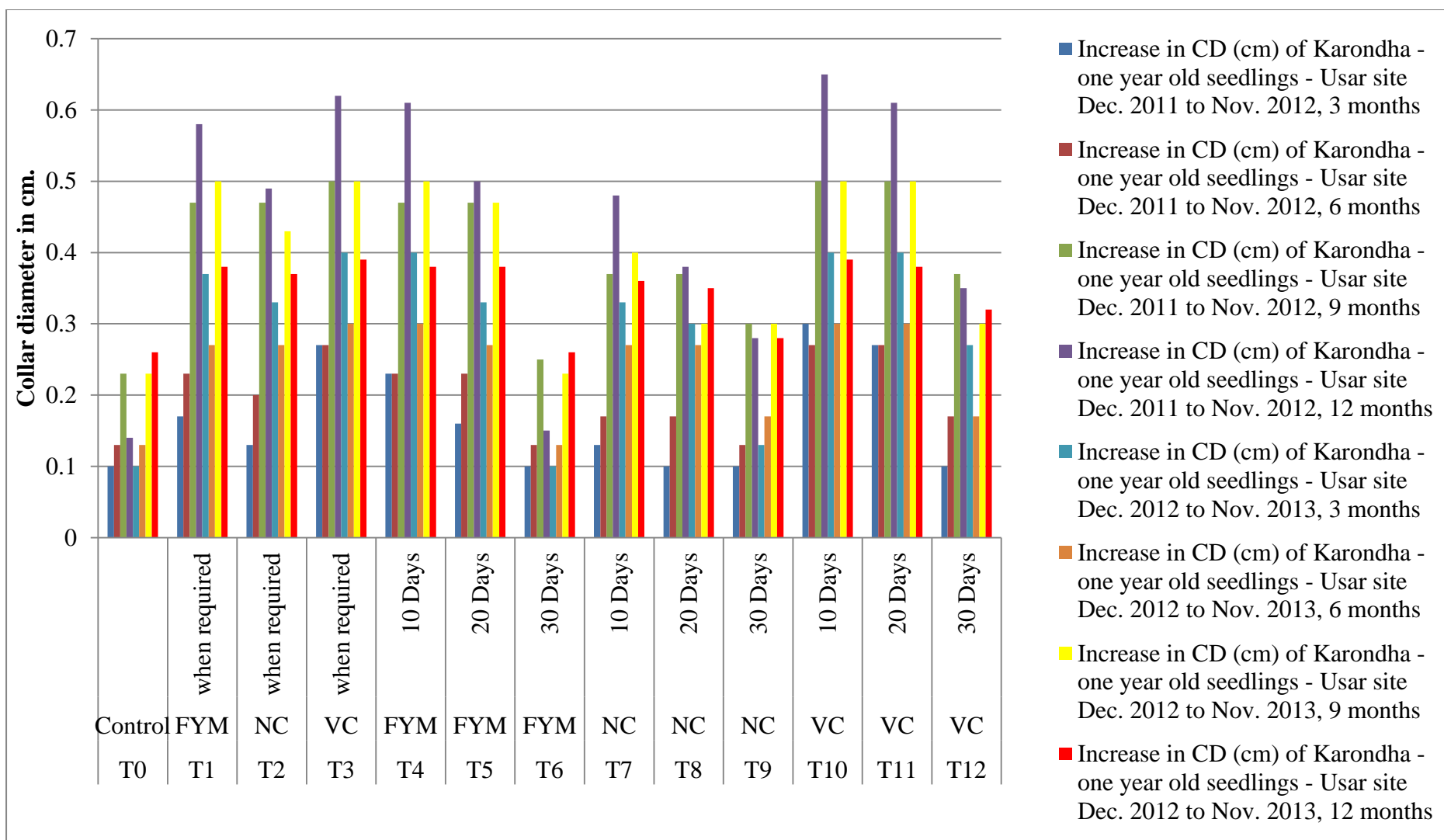


Fig. 4.11.2. Increase in Collar diameter (cm) of one year old seedling of Karondha at Usar site in December, 2011 to November, 2013.

4.11.3. Survival percentage of *Carissa carandas* (Karondha) – one year old seedling at Usar site at different intervals in December, 2011 to November, 2012 and December, 2012 to November, 2013.

The Plant Survival percentage during first year (Table 4.11.3.) -

The survivality in first year of 3 and 6 month reported Karondha seedlings grown at Usar sites with different intervals of irrigation schedule along with the applications of organic manures available or provide in a form of different treatment combinations.

The study clearly indicates non significant maximum survival percentage i.e. 100% was found in T₀, T₁, T₂, T₃, T₄, T₅, T₆, T₇, T₈, T₉, T₁₀, T₁₁ and T₁₂ treatment.

The survivality in first year of 9 month reported Karondha seedlings grown at Usar sites with different intervals of irrigation schedule along with the applications of organic manures available or provide in a form of different treatment combinations.

The study clearly indicates non significant maximum survival percentage i.e. 100% was found in T₁, T₂, T₃, T₄, T₅, T₆, T₇, T₈, T₁₀, T₁₁ and T₁₂ treatment. This followed T₀ and T₉ with 66.67 percent which shows minimum survival percentage of Karondha seedlings.

The survivality in first year of 12 month reported Karondha seedlings grown at usar sites with different intervals of irrigation schedule along with the applications of organic manures available or provide in a form of different treatment combinations.

The study clearly indicates non significant maximum survival percentage i.e. 100% was found in T₁, T₂, T₃, T₄, T₅, T₇, T₈, T₁₀, T₁₁ and T₁₂ due to good soil condition, nature of soil fertility availability essential minerals & nutrients, proper and good health condition of karondha seedlings and its adaptability. This followed T₀, T₉ and T₆ with 66.67 percent which shows minimum survival percentage of Karondha seedlings because of some deficiencies are found present in usar site with decrease physical properties of soil. Overall it is observed that treatment T₁₀ (vermicompost @ 10 days of irrigation schedule) with maximum survivality or survival % i.e. 100@ along with other attributes or observatory parameters would consider the best treatment combination.

The Plant Survival percentage during second year (Table 4.11.3.) -

The survivality in second year of 3 month reported Karondha seedlings grown at usar sites with different intervals of irrigation schedule along with the applications of organic manures available or provide in a form of different treatment combinations.

The study clearly indicates non significant maximum survival percentage i.e.100% was found in T₁, T₂, T₃, T₄ T₅, T₇, T₈, T₁₀, T₁₁ and T₁₂ treatment. This followed T₀, T₉ and T₆ with 66.67 percent which shows minimum survival percentage of Karondha seedlings.

The survivality in second year of 6, 9 and 12 month reported Karondha seedlings grown at usar sites with different intervals of irrigation schedule along with the applications of organic manures available or provide in a form of different treatment combinations.

The study clearly indicates non significant maximum survival percentage i.e. 100% was found in T₁, T₂, T₃, T₄ T₅, T₇, T₈, T₁₀, T₁₁ and T₁₂ due to good soil condition, nature of soil fertility availability essential minerals & nutrients, proper and good health condition of karondha seedlings and its adaptability. This followed T₆ and T₉ with 66.67 percent and treatment T₀ (control) which shows (33.33%) minimum survival percentage of karondha seedlings because of some deficiencies are found present in usar site or decrease in physical nature of soil. Overall it is observed that treatment T₁₀ (vermicompost @ 10 days of irrigation schedule) with maximum survivality or survival % i.e. 100@ along with other attributes or observatory parameters would consider the best treatment combination.

Table 4.11.3. Survival percentage of one year old seedlings of Karondha (*Carissa carandas*) at Usar site at different intervals (Year-wise)

Treatment No.	Treatment		Survival percentage of Karondha - one year old seedlings - Usar site									
			December, 2011 to November, 2012					December, 2012 to November, 2013				
	Organic manure	Irrigation schedule	3 months	6 months	9 months	12 months	Total	3 months	6 months	9 months	12 months	Total
T ₀	Control		100.00	100.00	66.67	66.67	66.67	66.67	33.33	33.33	33.33	33.33
T ₁	FYM	When required	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₂	NC	When required	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₃	VC	When required	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₄	FYM	10 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₅	FYM	20 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₆	FYM	30 Days	100.00	100.00	100.00	66.67	66.67	66.67	66.67	66.67	66.67	66.67
T ₇	NC	10 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₈	NC	20 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₉	NC	30 Days	100.00	100.00	66.67	66.67	66.67	66.67	66.67	66.67	66.67	66.67
T ₁₀	VC	10 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₁₁	VC	20 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₁₂	VC	30 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
		F- test	NS	NS	NS	NS		NS	NS	NS	NS	
		S. Ed. (\pm)	-	-	-	-		-	-	-	-	
		C. D. (P = 0.05)	-	-	-	-		-	-	-	-	

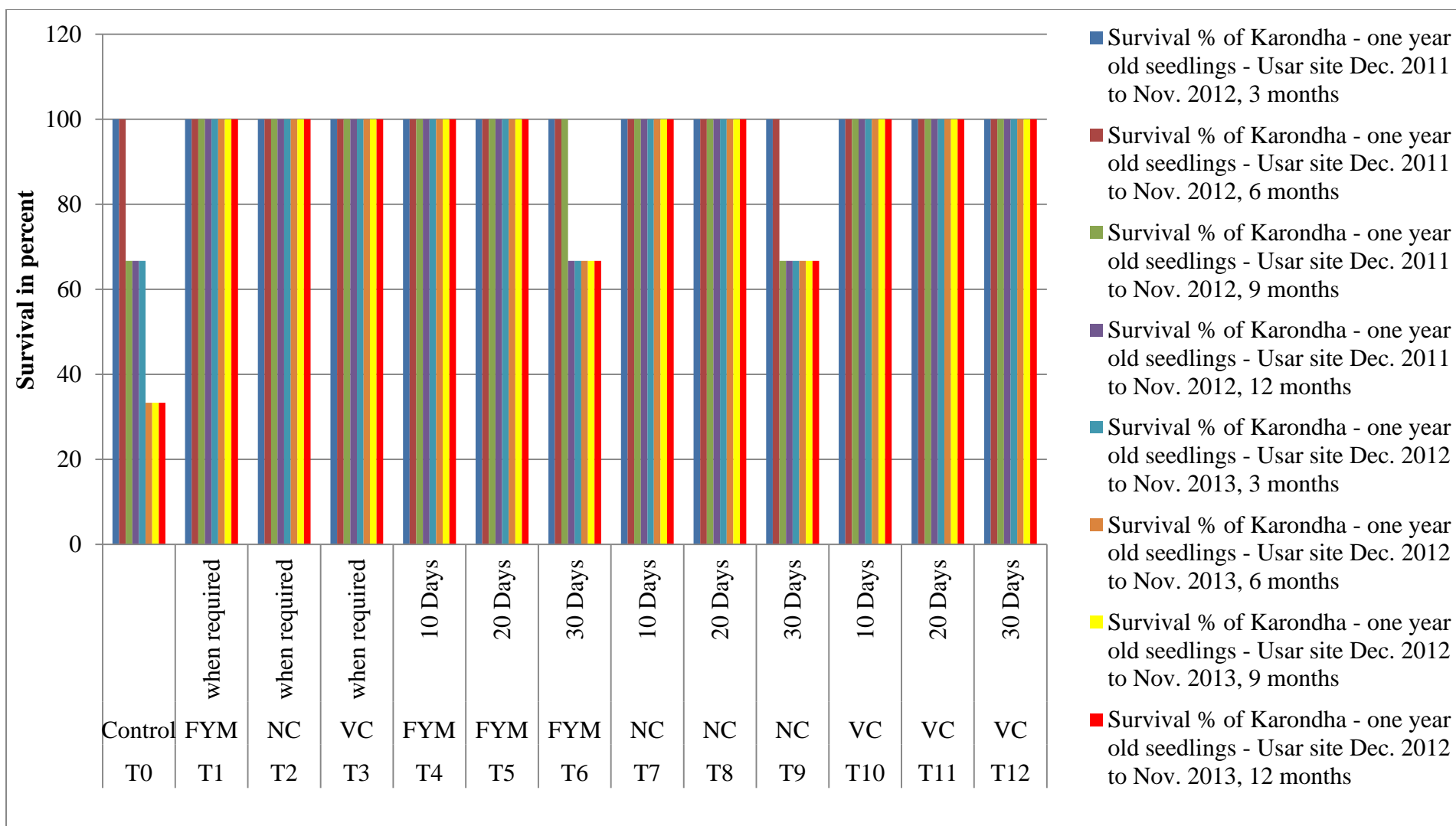


Fig. 4.11.3. Increase in Collar diameter (cm) of one year old seedling of Karondha at Usar site in December, 2011 to November, 2013.

4.12. Two year old seedling plantation of *Carissa carandas* (Karondha) at Usar site:

4.12.1. Increase in plant height (cm) of two year old seedling of *Carissa carandas* (Karondha) at Usar site in December, 2011 to November, 2012 and December, 2012 to November, 2013.

The Plant height during first year (Table 4.12.1.) -

The results of the average plant height after 3 month (0.76cm) was observed maximum in the treatment T_{10} and followed by T_3 (0.74cm), T_{11} (0.73cm) and T_4 (0.72cm), However, minimum was recorded in T_0 (0.57cm).

Plant height after 6 month (2.03cm) was observed maximum in T_{10} and followed by T_3 (1.93cm), T_4 (1.69cm) and T_{11} (1.67cm). However, minimum was recorded in T_0 (0.72cm).

Plant height after 9 month (8.53cm) was observed maximum in T_{10} and followed by T_3 (7.87cm), T_{11} (7.87cm), T_4 (7.62cm) and T_1 (7.23cm). However, minimum was recorded in T_0 (6.30cm).

Plant height after 12 month (4.67cm) was observed maximum in T_{10} and followed by T_3 (4.47cm), T_{11} (4.43cm) and T_4 (4.30cm). However, minimum was recorded in T_0 (3.33cm). Other organic manure and irrigation schedule showed the significant difference in the plant height in all monthly treatment of first year.

The Plant height during second year (Table 4.12.1.) -

The results of the average plant height after 3 month (0.73cm) was observed maximum in the treatment T_{10} and followed by T_3 (0.70cm), T_{11} (0.70cm) and T_4 (0.67cm), However, minimum was recorded in T_0 (0.54cm).

Plant height after 6 month (4.13cm) was observed maximum in T_{10} and followed by T_3 (4.03cm), T_{11} (3.93cm) and T_4 (3.90cm). However, minimum was recorded in T_0 (2.60cm).

Plant height after 9 month (10.67cm) was observed maximum in T_{10} and followed by T_3 (10.10cm), T_{11} (10.10cm), T_4 (10.03cm) and T_1 (9.90cm). However, minimum was recorded in T_0 (6.41cm).

Plant height after 12 month (6.31cm) was observed maximum in T₁₀ and followed by T₁₁ (6.09cm), T₃ (6.28cm) and T₄ (5.82cm). However, minimum was recorded in T₀ (3.66cm). Other organic manure and irrigation schedule showed the significant difference in the plant height in all monthly treatment of second year.

Table 4.12.1. Increase in plant height (cm) of two years old seedlings of Karondha (*Carissa carandas*) at Usar site at different intervals (Year-wise)

Treatment No.	Treatment		Increase in plant height (cm) of Karondha - two years old seedlings - Usar site									
			December, 2011 to November, 2012					December, 2012 to November, 2013				
	Organic manure	Irrigation schedule	3 months	6 months	9 months	12 months	Total	3 months	6 months	9 months	12 months	Total
T ₀	Control		0.57	0.72	6.30	3.33	10.92	0.54	2.60	6.41	3.66	13.21
T ₁	FYM	When required	0.70	1.27	7.23	4.20	13.40	0.67	3.70	9.90	5.65	19.92
T ₂	NC	When required	0.66	1.12	6.93	4.10	12.81	0.67	3.47	9.77	5.40	19.30
T ₃	VC	When required	0.74	1.93	7.87	4.47	15.01	0.70	4.03	10.10	6.28	21.12
T ₄	FYM	10 Days	0.72	1.69	7.62	4.30	14.33	0.67	3.90	10.03	5.82	20.42
T ₅	FYM	20 Days	0.68	1.21	7.13	4.20	13.22	0.67	3.67	9.83	5.62	19.78
T ₆	FYM	30 Days	0.57	0.76	6.30	3.33	10.96	0.54	2.61	6.41	3.66	13.22
T ₇	NC	10 Days	0.65	1.10	6.89	3.97	12.61	0.67	3.30	9.70	5.33	19.00
T ₈	NC	20 Days	0.63	0.97	6.86	3.83	12.30	0.67	3.23	9.57	5.18	18.65
T ₉	NC	30 Days	0.62	0.85	6.53	3.63	11.64	0.59	2.93	8.60	4.87	16.98
T ₁₀	VC	10 Days	0.76	2.03	8.53	4.67	15.99	0.73	4.13	10.67	6.31	21.85
T ₁₁	VC	20 Days	0.73	1.76	7.87	4.43	14.79	0.70	3.93	10.10	6.09	20.83
T ₁₂	VC	30 Days	0.62	0.92	6.77	3.70	12.02	0.60	3.07	9.47	5.01	18.14
		F- test	S	S	S	S		S	S	S	S	
		S. Ed. (±)	0.01	0.14	1.55	0.82		0.12	0.56	1.73	1.08	
		C. D. (P = 0.05)	0.03	0.30	3.19	1.70		0.25	1.17	3.58	2.24	

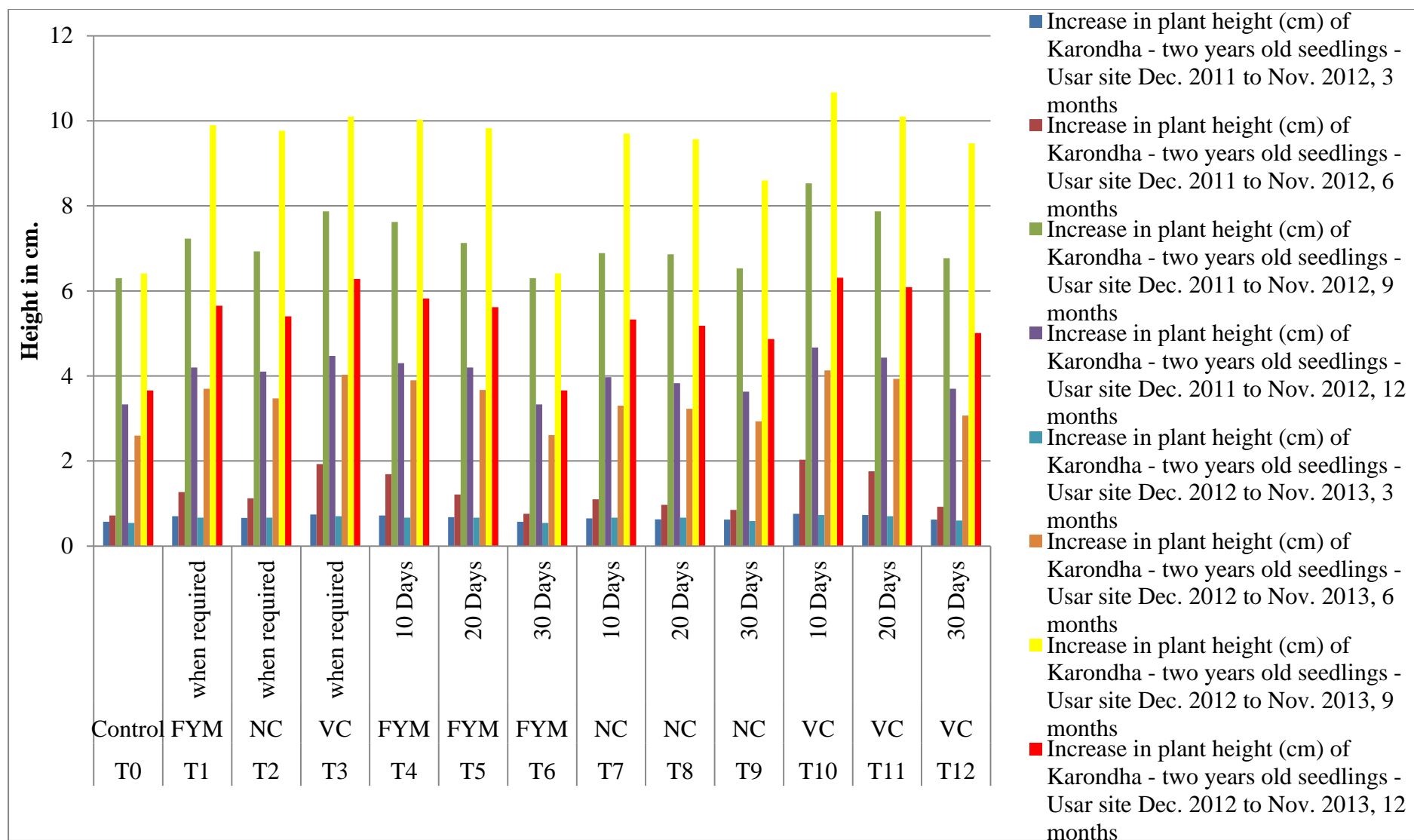


Fig. 4.12.1. Increase in plant height (cm) of two year old seedling of Karondha at Usar site in December, 2011 to November, 2013.

4.12.2. Increase in Collar diameter (cm) of two year old seedling of *Carissa carandas* (Karondha) at Usar site in December, 2011 to November, 2012 and December, 2012 to November, 2013.

The Plant Collar diameter during first year (Table 4.12.2.) -

The results of the average Collar diameter after 3 month (0.37cm) was observed maximum in the treatment T₁₀ and followed by T₃(0.30cm), T₁₁(0.27cm) and T₄(0.23cm), However, minimum increase Collar diameter was recorded in T₀ (0.10cm).

Collar diameter after 6 month (0.33cm) was observed maximum in T₁₀ and followed by T₃ (0.30cm), T₁₁ (0.27cm), T₄ (0.23cm). However, minimum increase Collar diameter was recorded in T₀ (0.13cm).

Collar diameter after 9 month (0.70cm) was observed maximum in T₁₀ and followed by T₃ (0.70cm), T₁₁ (0.67cm), T₁ (0.60cm) and T₄ (0.60cm). However, minimum increase Collar diameter was recorded in T₀ (0.43cm).

Collar diameter after 12 month (0.86cm) was observed maximum in T₁₀ and followed by T₃ (0.77cm), T₁₁ (0.68cm) and T₄ (0.62cm). However, minimum increase Collar diameter was recorded in T₀ (0.39cm). Other organic manure and irrigation schedule showed the significant differences in the plant collar diameter in all monthly treatment of first year.

The Plant Collar diameter during second year (Table 4.12.2.) -

The results of the average Collar diameter after 3 month (0.40cm) was observed maximum in the treatment T₁₀ and followed by T₃ (0.37cm), T₁₁ (0.37cm) and T₄ (0.33cm) , However, minimum increase Collar diameter was recorded in T₀ (0.20cm).

Collar diameter after 6 month (0.30cm) was observed maximum in T₁₀ and followed by T₃ (0.30cm), T₁₁ (0.30cm), T₄ (0.30cm). However, minimum increase Collar diameter was recorded in T₀ (0.17cm).

Collar diameter after 9 month (0.70cm) was observed maximum in T₁₀ and followed by T₃ (0.70cm), T₁₁ (0.70cm), T₁ (0.60cm) and T₄ (0.67cm). However, minimum increase Collar diameter was recorded in T₀ (0.43cm).

Collar diameter after 12 month (0.48cm) was observed maximum in T₁₀ and followed by T₃ (0.48cm), T₁₁ (0.48cm) and T₄ (0.47cm). However, minimum increase Collar diameter was recorded in T₀ (0.37cm). Other organic manure and irrigation schedule showed the significant differences in the plant collar diameter in all monthly treatment of second year.

Table 4.12.2. Increase in collar diameter (cm) of two years old seedlings of Karondha (*Carissa carandas*) at Usar site at different intervals (Year-wise)

Treatment No.	Treatment		Increase in collar diameter (cm) of Karondha - two years old seedlings - Usar site									
	Organic manure	Irrigation schedule	December, 2011 to November, 2012					December, 2012 to November, 2013				
			3 months	6 months	9 months	12 months	Total	3 months	6 months	9 months	12 months	Total
T ₀	Control		0.10	0.13	0.43	0.39	1.05	0.20	0.17	0.43	0.37	1.17
T ₁	FYM	When required	0.23	0.23	0.60	0.58	1.65	0.33	0.30	0.60	0.45	1.68
T ₂	NC	When required	0.17	0.23	0.53	0.52	1.45	0.33	0.27	0.57	0.43	1.60
T ₃	VC	When required	0.30	0.30	0.70	0.77	2.07	0.37	0.30	0.70	0.48	1.85
T ₄	FYM	10 Days	0.23	0.23	0.60	0.62	1.68	0.33	0.30	0.67	0.47	1.77
T ₅	FYM	20 Days	0.20	0.23	0.53	0.57	1.54	0.33	0.30	0.57	0.43	1.63
T ₆	FYM	30 Days	0.10	0.13	0.43	0.40	1.07	0.20	0.17	0.43	0.37	1.17
T ₇	NC	10 Days	0.17	0.23	0.50	0.51	1.41	0.30	0.27	0.50	0.40	1.47
T ₈	NC	20 Days	0.17	0.23	0.50	0.43	1.33	0.27	0.27	0.47	0.40	1.40
T ₉	NC	30 Days	0.13	0.20	0.43	0.41	1.17	0.23	0.23	0.43	0.38	1.28
T ₁₀	VC	10 Days	0.37	0.33	0.70	0.86	2.26	0.40	0.30	0.70	0.48	1.88
T ₁₁	VC	20 Days	0.27	0.27	0.67	0.68	1.88	0.37	0.30	0.70	0.48	1.85
T ₁₂	VC	30 Days	0.16	0.20	0.43	0.42	1.22	0.23	0.23	0.43	0.39	1.29
		F- test	S	S	S	S		S	S	S	S	
		S. Ed. (\pm)	0.02	0.03	0.07	0.17		0.07	0.05	0.07	0.06	
		C. D. (P = 0.05)	0.05	0.07	0.15	0.34		0.14	0.10	0.15	0.13	

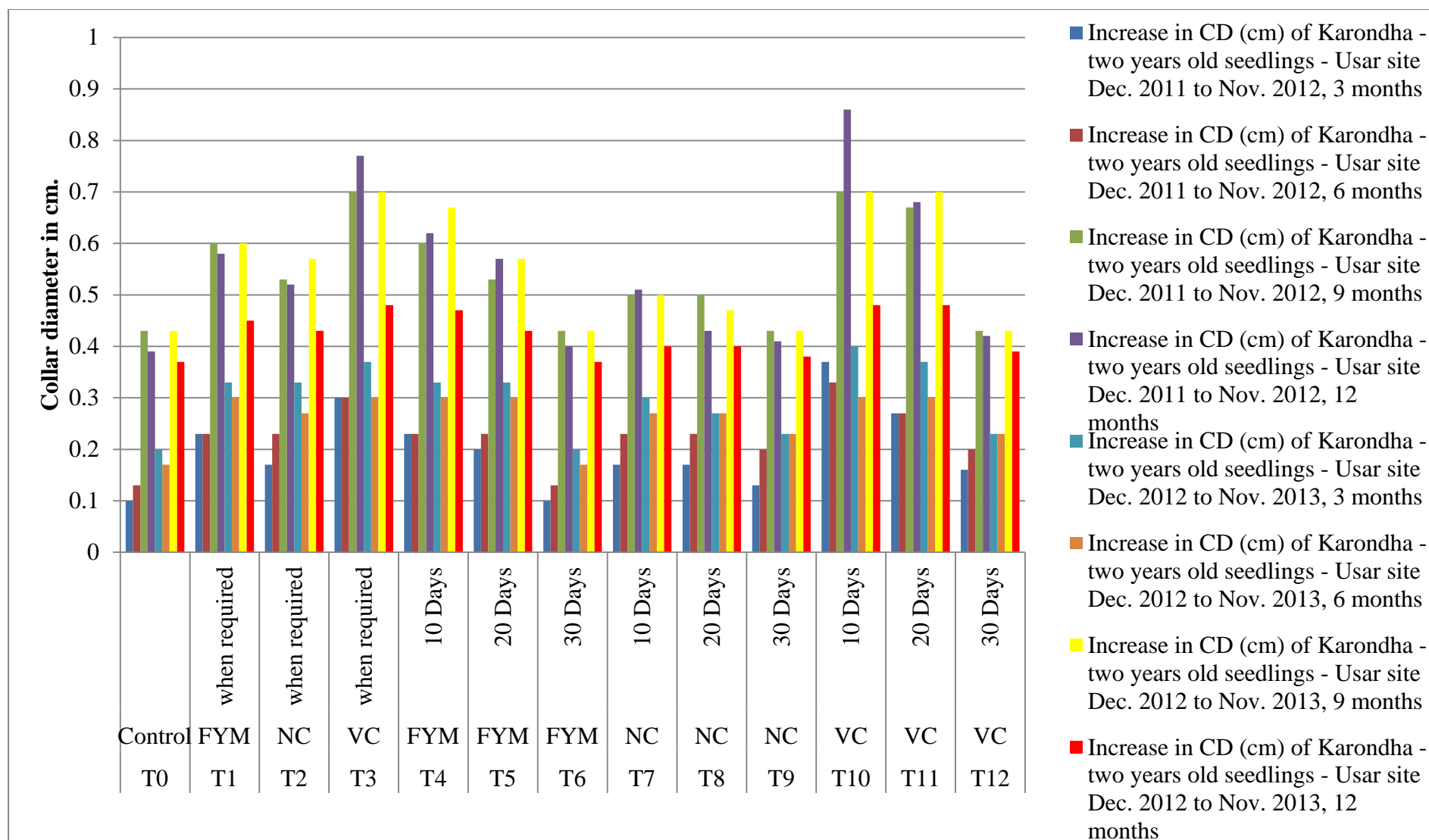


Fig. 4.12.2. Increase in Collar diameter (cm) of two year old seedling of Karondha at Usar site in December, 2011 to November, 2013.

4.12.3. Survival percentage of *Carissa carandas* (Karondha) – two year old seedling at usar site at different intervals in December -2011 to November 2012 and December, 2012 to November, 2013.

The Plant Survival percentage during first year (Table 4.12.3.) -

The survivability in first year of 3 reported Karondha seedlings grown at usar sites with different intervals of irrigation schedule along with the applications of organic manures available or provide in a form of different treatment combinations.

The study clearly indicates non significant maximum survival percentage i.e. 100% was found in T₀, T₁, T₂, T₃, T₄, T₅, T₆, T₇, T₈, T₉, T₁₀, T₁₁ and T₁₂ treatment.

The survivability in first year of 6, 9 and 12 month reported Karondha seedlings grown at usar sites with different intervals of irrigation schedule along with the applications of organic manures available or provide in a form of different treatment combinations.

The study clearly indicates non significant maximum survival percentage i.e. 100% was found in T₁, T₂, T₃, T₄, T₅, T₇, T₈, T₁₀, T₁₁ and T₁₂ due to good soil condition, nature of soil fertility availability essential minerals & nutrients, proper and good health condition of karondha seedlings and its adaptability. This followed T₆ and T₉ with 66.67 percent and treatment T₀ (control) which shows (33.33%) minimum survival percentage of karondha seedlings because of some deficiencies are found present in usar site or decrease in physical nature of soil. Overall it is observed that treatment T₁₀ (vermicompost @ 10 days of irrigation schedule) with maximum survivability or survival % i.e. 100% along with other attributes or observatory parameters would consider the best treatment combination.

The Plant Survival percentage during second year (Table 4.12.3.) -

The survivability in second year of 3, 6, 9 and 12 month reported Karondha seedlings grown at usar sites with different intervals of irrigation schedule along with the applications of organic manures available or provide in a form of different treatment combinations.

The study clearly indicates non significant maximum survival percentage i.e. 100% was found in T₁, T₂, T₃, T₄, T₅, T₇, T₈, T₁₀, T₁₁ and T₁₂ due to good soil condition,

nature of soil fertility availability essential minerals & nutrients, proper and good health condition of karondha seedlings and its adaptability. This followed T₆ and T₉ with 66.67 percent and treatment T₀ (control) which shows (33.33%) minimum survival percentage of karondha seedlings because of some deficiencies are found present in usar site or decrease in physical nature of soil. Overall it is observed that treatment T₁₀ (vermicompost @ 10 days of irrigation schedule) with maximum survivality or survival % i.e. 100@ along with other attributes or observatory parameters would consider the best treatment combination.

Table 4.12.3. Survival percentage of two years old seedlings of Karondha (*Carissa carandas*) at Usar site at different intervals (Year-wise)

Treatment No.	Treatment		Survival percentage of Karondha - two years old seedlings - Usar site									
			December, 2011 to November, 2012					December, 2012 to November, 2013				
			3 months	6 months	9 months	12 months	Total	3 months	6 months	9 months	12 months	Total
T ₀	Control		100.00	33.33	33.33	33.33	33.33	33.33	33.33	33.33	33.33	33.33
T ₁	FYM	When required	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₂	NC	When required	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₃	VC	When required	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₄	FYM	10 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₅	FYM	20 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₆	FYM	30 Days	100.00	66.67	66.67	66.67	66.67	66.67	66.67	66.67	66.67	66.67
T ₇	NC	10 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₈	NC	20 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₉	NC	30 Days	100.00	66.67	66.67	66.67	66.67	66.67	66.67	66.67	66.67	66.67
T ₁₀	VC	10 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₁₁	VC	20 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₁₂	VC	30 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
		F- test	NS	NS	NS	NS		NS	NS	NS	NS	
		S. Ed. (±)	-	-	-	-		-	-	-	-	
		C. D. (P = 0.05)	-	-	-	-		-	-	-	-	

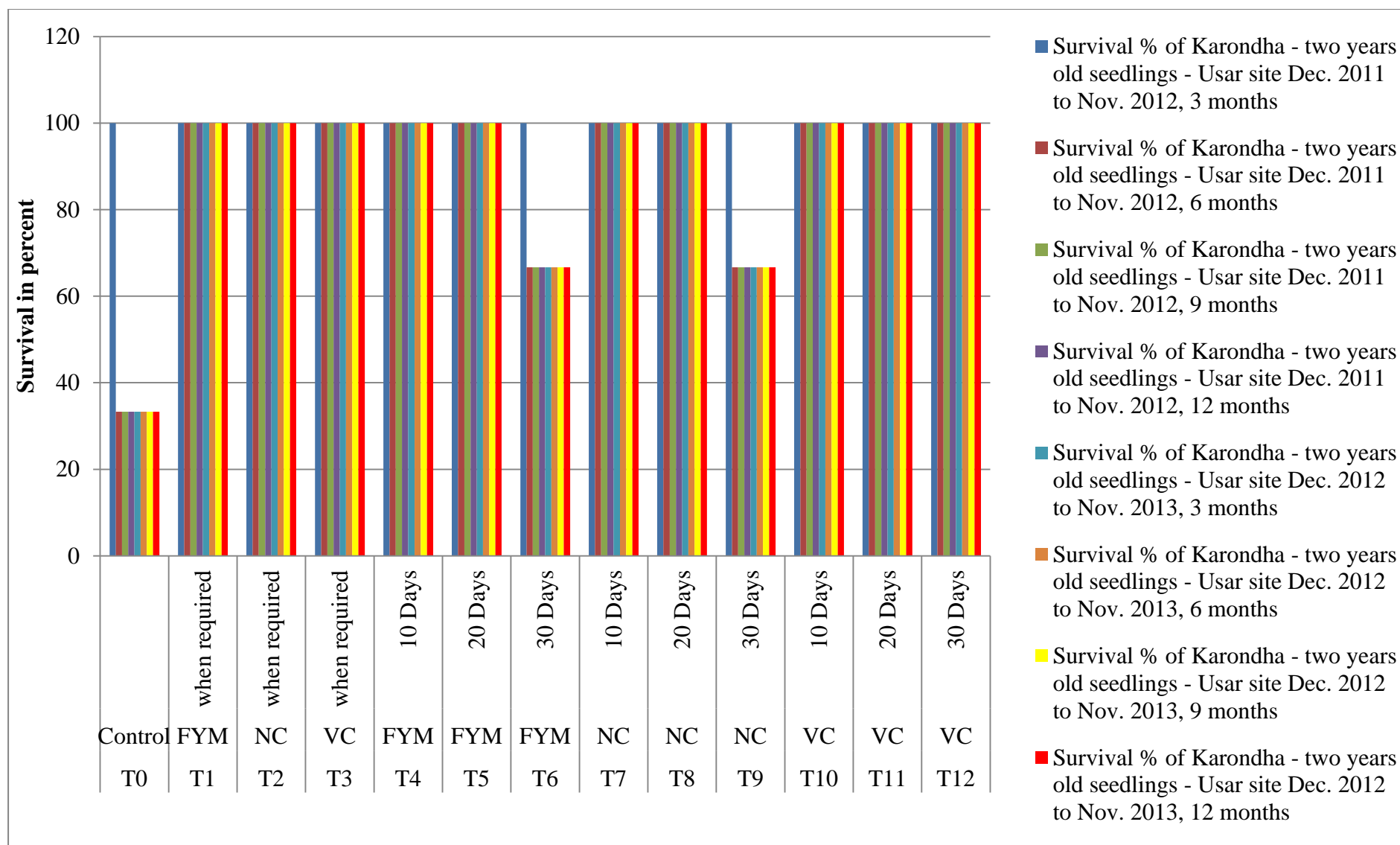


Fig. 4.12.3. Survival percentage of two year old seedling of Karondha at Usar site in December, 2011 to November, 2013.

4.13. Six month old seedling plantation of *Pongamia pinnata* (Karanj) at Usar site:

4.13.1. Increase in plant height (cm) of six month old seedling of *Pongamia pinnata* (Karanj) at Usar site in December, 2011 to November, 2012 and December, 2012 to November, 2013.

The Plant height during first year (Table 4.13.1.) -

The results of the average plant height after 3 month (5.67cm) was observed maximum in the treatment T₁₀ and followed by T₃ (5.33cm), T₁₁ (4.67cm) and T₄ (4.67cm). However, minimum was recorded in T₀ (3.33cm).

Plant height after 6 month (10.00cm) was observed maximum in T₁₀ and followed by T₃ (6.67cm), T₁₁ (6.00cm) and T₄ (5.70cm). However, minimum was recorded in T₀ (2.30cm).

Plant height after 9 month (11.67cm) was observed maximum in T₁₀ and followed by T₃ (10.67cm), T₁₁ (10.63cm) and T₄ (10.33cm). However, minimum was recorded in T₀ (4.70cm).

Plant height after 12 month (15.63cm) was observed maximum in T₁₀ and followed by T₃ (13.67cm), T₁₁ (13.13cm) and T₄ (12.67cm). However, minimum was recorded in T₀ (8.73cm). Other organic manure and irrigation schedule showed the significant difference in the plant height in all monthly treatment of first year.

The Plant height during second year (Table 4.13.1.) -

The results of the average plant height after 3 month (6.00cm) was observed maximum in the treatment T₁₀ and followed by T₃ (5.67cm), T₁₁ (5.67cm) and T₄ (5.67cm). However, minimum was recorded in T₀ (2.33cm).

Plant height after 6 month (13.33cm) was observed maximum in T₁₀ and followed by T₃ (9.67cm), T₁₁ (8.67cm) and T₄ (7.67cm). However, minimum was recorded in T₀ (3.00cm).

Plant height after 9 month (21.97cm) was observed maximum in T₁₀ and followed by T₃ (19.00cm), T₁₁ (18.87cm) and T₄ (18.33cm). However, minimum was recorded in T₀ (10.83cm).

Plant height after 12 month (24.07cm) was observed maximum in T₁₀ and followed by T₃ (23.67cm), T₁₁ (22.80cm) and T₄ (22.07cm). However, minimum was recorded in T₀ (11.33cm). Other organic manure and irrigation schedule showed the significant difference in the plant height in all monthly treatment of second year.

Table4.13.1. Increase in plant height (cm) of six months old seedlings of Karanj (*Pongamia pinnata*) at Usar site at different intervals (Year-wise)

Treatment No.	Treatment		Increase in plant height (cm) of Karanj - 6 months old seedlings - Usar site									
			December, 2011 to November, 2012					December, 2012 to November, 2013				
	Organic manure	Irrigation schedule	3 months	6 months	9 months	12 months	Total	3 months	6 months	9 months	12 months	Total
T ₀	Control		3.33	2.30	4.70	8.73	19.06	2.33	3.00	10.83	11.33	27.49
T ₁	FYM	When required	4.67	5.67	10.33	12.67	33.34	5.67	6.33	17.99	20.67	50.66
T ₂	NC	When required	4.33	5.67	9.67	11.30	30.97	5.33	5.00	15.00	18.67	44.00
T ₃	VC	When required	5.33	6.67	10.67	13.67	36.34	5.67	9.67	19.00	23.67	58.01
T ₄	FYM	10 Days	4.67	5.70	10.33	12.67	33.37	5.67	7.67	18.33	22.07	53.74
T ₅	FYM	20 Days	4.67	5.67	9.67	11.93	31.94	5.33	6.00	16.57	20.13	48.03
T ₆	FYM	30 Days	4.00	4.67	7.30	9.97	25.94	4.33	4.33	13.33	14.67	36.66
T ₇	NC	10 Days	4.33	5.67	8.33	10.10	28.43	5.33	4.67	14.87	16.67	41.54
T ₈	NC	20 Days	4.33	5.33	7.67	10.07	27.40	4.67	4.67	14.00	15.67	39.01
T ₉	NC	30 Days	3.33	2.33	4.70	8.73	19.09	2.33	3.00	10.83	11.33	27.49
T ₁₀	VC	10 Days	5.67	10.00	11.67	15.63	42.97	6.00	13.33	21.97	24.07	65.37
T ₁₁	VC	20 Days	4.67	6.00	10.63	13.13	34.44	5.67	8.67	18.87	22.80	56.01
T ₁₂	VC	30 Days	4.00	4.65	5.67	8.97	23.29	4.00	4.00	13.33	14.33	35.66
		F- test	S	S	S	S		S	S	S	S	
		S. Ed. (±)	0.13	0.71	1.08	1.88		0.61	0.95	2.75	2.92	
		C. D. (P = 0.05)	0.27	1.47	2.22	3.87		1.25	1.97	5.67	6.03	

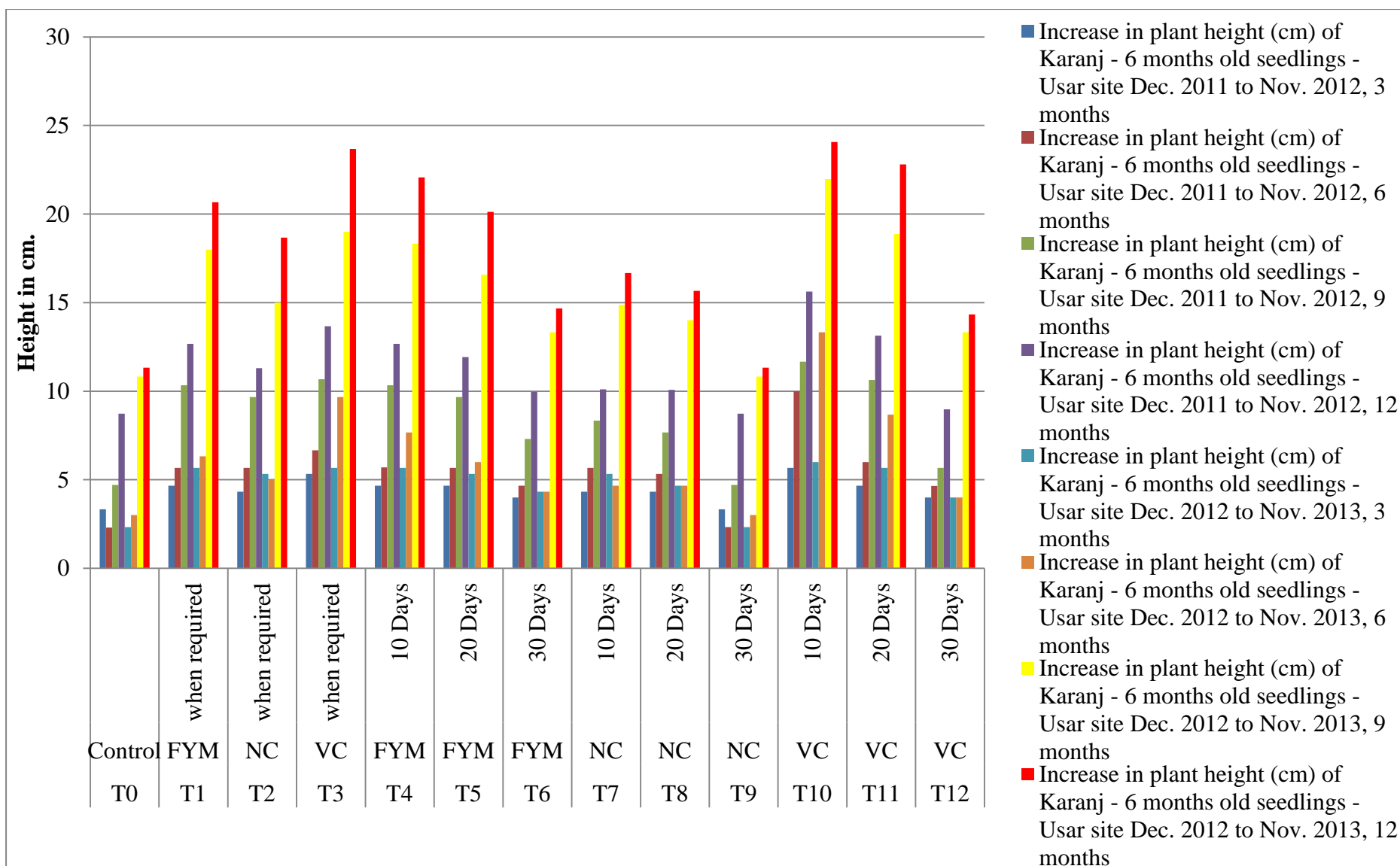


Fig.4.13.1. Increase in plant height (cm) of six month old seedling of Karanj at Usar site in December, 2011 to November, 2013.

4.13.2. Increase in Collar diameter (cm) of six month old seedling of *Pongamia pinnata* (Karanj) at Usar site in December, 2011 to November, 2012 and December, 2012 to November, 2013.

The Plant Collar diameter during first year (Table 4.13.2.) -

The results of the average Collar diameter after 3 month (0.50cm) was observed maximum in the treatment T₁₀ and followed by T₃ (0.50cm), T₁₁ (0.46cm) and T₄ (0.42cm), However, minimum increase Collar diameter was recorded in T₀ (0.20cm).

Collar diameter after 6 month (0.50cm) was observed maximum in T₁₀ and followed by T₃ (0.43cm), T₁₁ (0.40cm) and T₄ (0.25cm). However, minimum increase Collar diameter was recorded in T₀ (0.15cm).

Collar diameter after 9 month (1.20cm) was observed maximum in T₁₀ and followed by T₃ (1.10cm), T₁₁ (0.78cm) and T₄ (0.70cm). However, minimum increase Collar diameter was recorded in T₀ (0.13cm).

Collar diameter after 12 month (1.20cm) was observed maximum in T₁₀ and followed by T₃ (1.20cm), T₁₁ (1.10cm) and T₄ (1.10cm). However, minimum increase Collar diameter was recorded in T₀ (0.59cm). Other organic manure and irrigation schedule showed the significant difference in the plant collar diameter in all monthly treatment of first year.

The Plant Collar diameter during second year (Table 4.13.2.) -

The results of the average Collar diameter after 3 month (0.43cm) was observed maximum in the treatment T₁₀ and followed by T₃ (0.42cm), T₁₁ (0.42cm) and T₄ (0.41cm), However, minimum increase Collar diameter was recorded in T₀ (0.20cm).

Collar diameter after 6 month (1.32cm) was observed maximum in T₁₀ and followed by T₃ (1.08cm), T₁₁ (0.96cm) and T₄ (0.94cm). However, minimum increase Collar diameter was recorded in T₀ (0.51cm). While as other organic manure and irrigation schedule showed the significant differences in the plant collar diameter.

Collar diameter after 9 month (1.29cm) was observed maximum in T₁₀ and followed by T₃(1.23cm), T₁₁(1.15cm) and T₄(1.14cm). However, minimum increase Collar diameter was recorded in T₀ (0.90cm).

Collar diameter after 12 month increase Collar diameter (1.90cm) was observed maximum in T₇ and followed by T₈ (1.89cm), T₂ (1.83cm) and T₄ (1.79cm). However, minimum increase Collar diameter was recorded in T₀ (1.37cm). Other organic manure and irrigation schedule showed the significant difference in the plant Collar diameter in all monthly treatment of second year.

Table 4.13.2. Increase in collar diameter (cm) of six months old seedlings of Karanj (*Pongamia pinnata*) at Usar site at different intervals (Year-wise)

Treatment No.	Treatment		Increase in collar diameter (cm) of Karanj - 6 months old seedlings - Usar site									
			December, 2011 to November, 2012					December, 2012 to November, 2013				
			3 months	6 months	9 months	12 months	Total	3 months	6 months	9 months	12 months	Total
T ₀	Control		0.20	0.15	0.13	0.59	1.07	0.20	0.51	0.90	1.37	2.98
T ₁	FYM	When required	0.41	0.20	0.67	1.10	2.38	0.41	0.84	1.07	1.77	4.09
T ₂	NC	When required	0.30	0.17	0.50	1.00	1.97	0.32	0.73	1.06	1.83	3.94
T ₃	VC	When required	0.50	0.43	1.10	1.20	3.23	0.42	1.08	1.23	1.46	4.19
T ₄	FYM	10 Days	0.42	0.25	0.70	1.10	2.47	0.41	0.94	1.14	1.79	4.28
T ₅	FYM	20 Days	0.40	0.19	0.60	1.00	2.19	0.41	0.82	1.07	1.79	4.08
T ₆	FYM	30 Days	0.23	0.13	0.29	0.80	1.45	0.23	0.64	1.05	1.61	3.53
T ₇	NC	10 Days	0.30	0.15	0.42	0.92	1.79	0.32	0.72	1.06	1.90	4.00
T ₈	NC	20 Days	0.30	0.13	0.42	0.90	1.75	0.30	0.66	1.05	1.89	3.90
T ₉	NC	30 Days	0.26	0.10	0.50	0.60	1.46	0.20	0.51	0.90	1.50	3.11
T ₁₀	VC	10 Days	0.50	0.50	1.20	1.20	3.40	0.43	1.32	1.29	1.58	4.62
T ₁₁	VC	20 Days	0.46	0.40	0.78	1.10	2.74	0.42	0.96	1.15	1.74	4.27
T ₁₂	VC	30 Days	0.23	0.12	0.50	0.78	1.63	0.21	0.63	0.91	1.47	3.22
		F- test	S	S	S	S		S	S	S	S	
		S. Ed. (±)	0.04	0.05	0.18	0.22		0.09	0.12	0.24	0.42	
		C. D. (P = 0.05)	0.08	0.11	0.37	0.45		0.18	0.25	0.49	0.86	

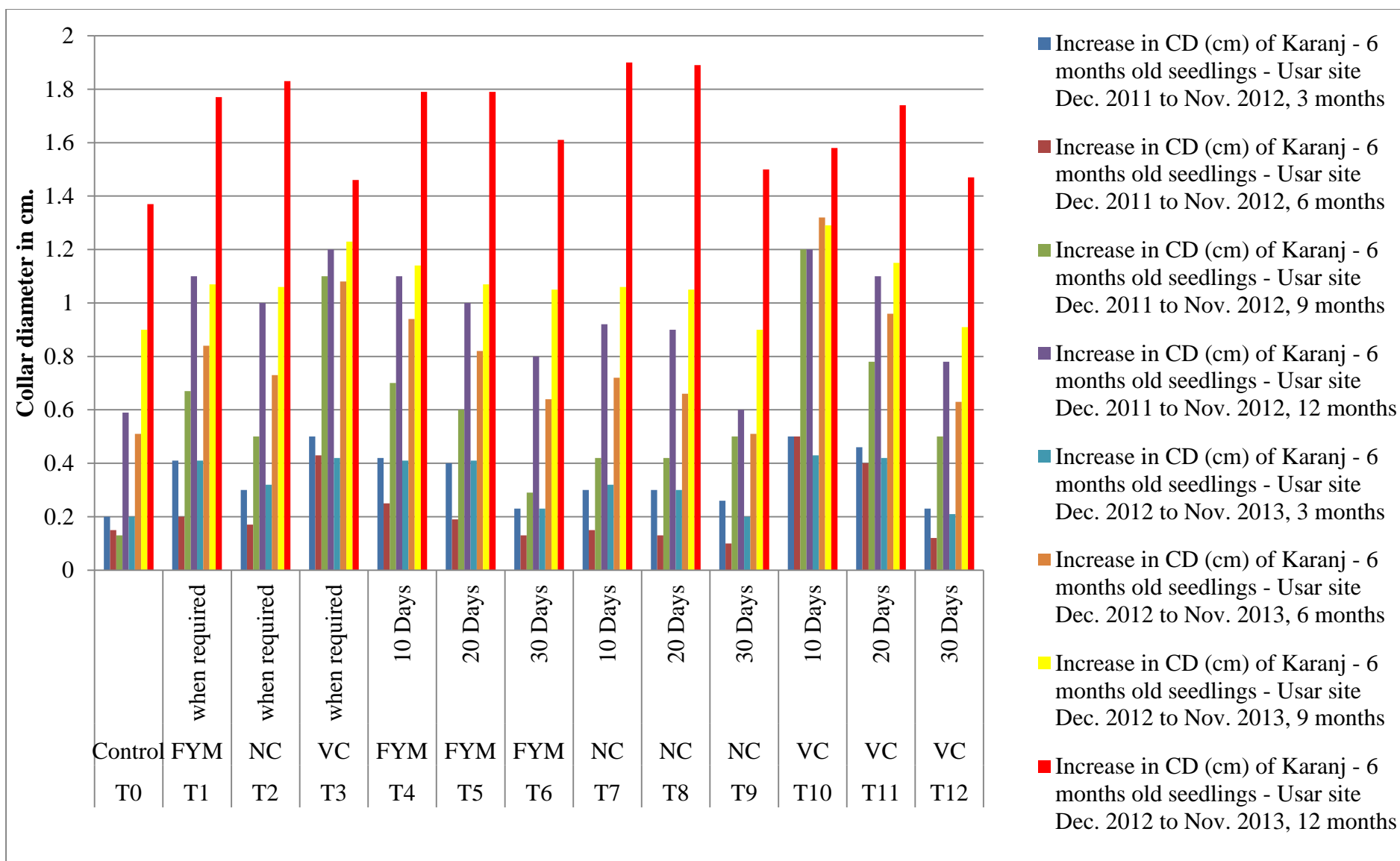


Fig. 4.13.2. Increase in Collar diameter (cm) of six month old seedling of Karanj at Usar sites in December, 2011 to November, 2013.

4.13.3. Survival percentage of *Pongamia pinnata* (Karanj) - 6 months old seedling at Usar site at different intervals in December, 2011 to November, 2012 and December, 2012 to November, 2013.

The Plant Survival percentage during first year (Table 4.13.3.) -

The survivability in first year of 3 month reported Karanj seedlings grown at Usar sites with different intervals of irrigation schedule along with the applications of organic manures available or provide in a form of different treatment combinations.

The study clearly indicates non significant maximum survival percentage i.e. 100% was found in T₀, T₁, T₂, T₃, T₄ T₅, T₆, T₇, T₈, T₉, T₁₀, T₁₁ and T₁₂ treatment.

The survivability in first year of 6, 9 and 12 month reported Karanj seedlings grown at Usar sites with different intervals of irrigation schedule along with the applications of organic manures available or provide in a form of different treatment combinations.

The study clearly indicates non significant maximum survival percentage i.e. 100% was found in T₁, T₂, T₃, T₄ T₅, T₆, T₇, T₈, T₁₀ and T₁₁ due to good soil condition, nature of soil fertility availability essential minerals & nutrients, proper and good health condition of Karanj seedlings and its adaptability. This followed T₀, T₉ and T₁₂, with 66.67 percent which shows minimum survival percentage of Karanj seedlings because of some deficiencies are found present in rocky site with decrease physical properties of soil. Overall it is observed that treatment T₁₀ (vermicompost @ 10 days of irrigation schedule) with maximum survivability or survival % i.e. 100@ along with other attributes or observatory parameters would consider the best treatment combination.

The Plant Survival percentage during second year (Table 4.13.3.) -

The survivability in second year of 3 month reported Karanj seedlings grown at Usar sites with different intervals of irrigation schedule along with the applications of organic manures available or provide in a form of different treatment combinations.

The study clearly indicates non significant maximum survival percentage i.e. 100% was found in T₁, T₂, T₃, T₄ T₅, T₆, T₇, T₈, T₁₀ and T₁₁ due to good soil condition, nature of soil fertility availability essential minerals & nutrients, proper and good health

condition of Karanj seedlings and its adaptability. This followed T₀, T₉ and T₁₂, with 66.67% which shows minimum survival percentage of Karanj seedlings.

The survivability in second year of 6, 9 and 12 month reported Karanj seedlings grown at Rocky sites with different intervals of irrigation schedule along with the applications of organic manures available or provide in a form of different treatment combinations.

The study clearly indicates significant maximum survival percentage i.e. 100% was found in T₁, T₂, T₃, T₄ T₅, T₆, T₇, T₈, T₁₀, T₁₁ and T₁₂ due to good soil condition, nature of soil fertility availability essential minerals & nutrients, proper and good health condition of Karanj seedlings and its adaptability. This followed T₉, T₁₂ with 66.67% and treatment T₀ (control) which shows (33.33%) minimum survival percentage of Karanj seedlings because of some deficiencies are found present in rocky site or decrease in physical nature of soil. Overall it is observed that treatment T₁₀ (vermicompost @ 10 days of irrigation schedule) with maximum survivability or survival % i.e. 100@ along with other attributes or observatory parameters would consider the best treatment combination.

Table 4.13.3. Survival percentage of six months old seedlings of Karanj (*Pongamia pinnata*) at Usar site at different intervals (Year-wise)

Treatment No.	Treatment		Survival percentage of Karanj - 6 months old seedlings - Usar site									
			December, 2011 to November, 2012					December, 2012 to November, 2013				
			3 months	6 months	9 months	12 months	Total	3 months	6 months	9 months	12 months	Total
T ₀	Control		100.00	66.67	66.67	66.67	66.67	66.67	33.33	33.33	33.33	33.33
T ₁	FYM	When required	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₂	NC	When required	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₃	VC	When required	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₄	FYM	10 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₅	FYM	20 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₆	FYM	30 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₇	NC	10 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₈	NC	20 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₉	NC	30 Days	100.00	66.67	66.67	66.67	66.67	66.67	66.67	66.67	66.67	66.67
T ₁₀	VC	10 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₁₁	VC	20 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₁₂	VC	30 Days	100.00	66.67	66.67	66.67	66.67	66.67	66.67	66.67	66.67	66.67
		F- test	NS	NS	NS	NS		NS	NS	NS	NS	
		S. Ed. (\pm)	-	-	-	-		-	-	-	-	
		C. D. (P = 0.05)	-	-	-	-		-	-	-	-	

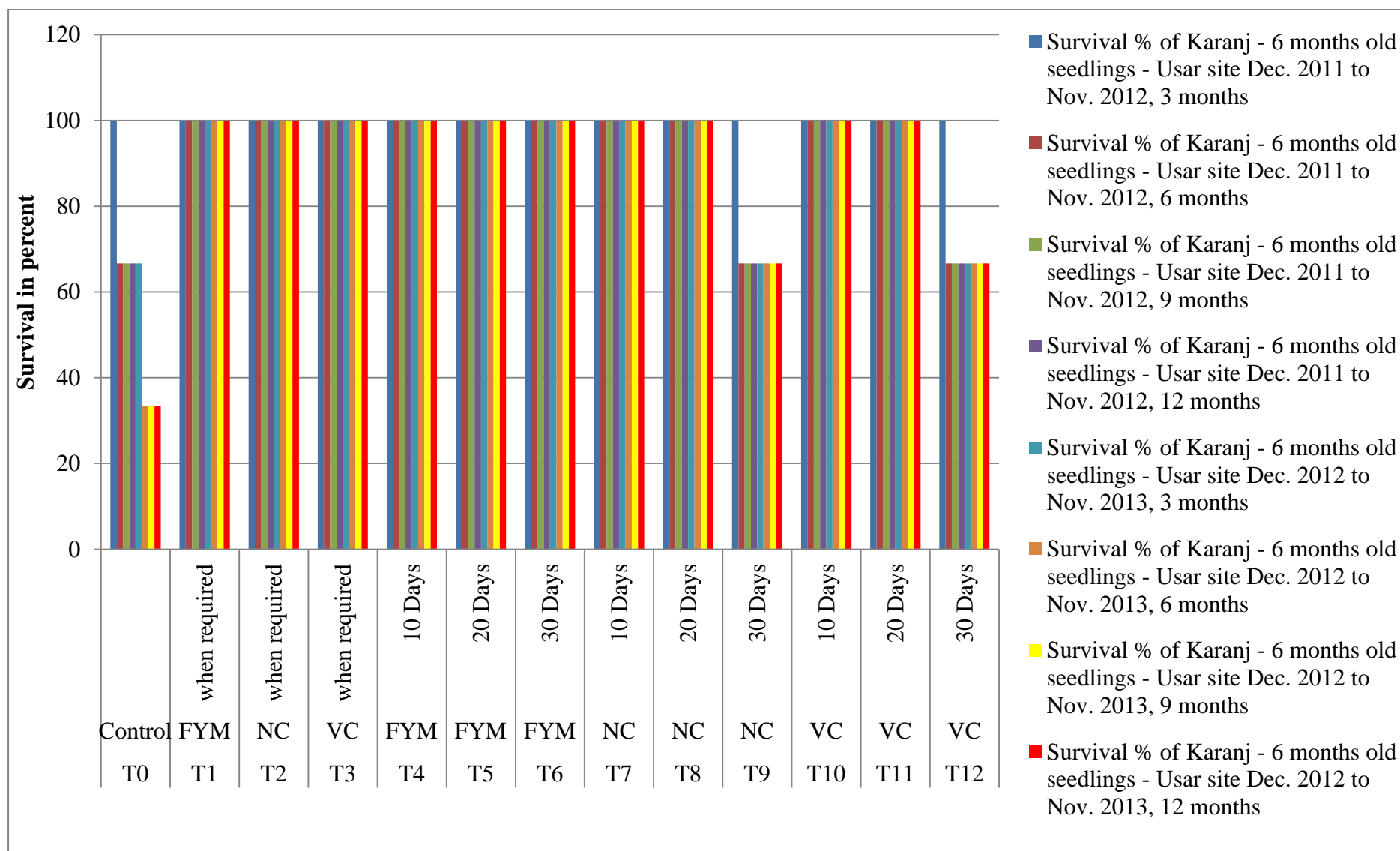


Fig. 4.4.13.3. Increase in Collar diameter (cm) of six month old seedling of Karanj at Usar sites in December, 2011 to November, 2013.

4.14. One year old seedling plantation of *Pongamia pinnata* (Karanj) at Usar site:

4.14.1. Increase in plant height (cm) of one year old seedling of *Pongamia pinnata* (Karanj) at Usar site in December, 2011 to November, 2012 and December, 2012 to November, 2013.

The Plant height during first year (Table 4.14.1.) -

The results of the average plant height after 3 month (8.67cm) was observed maximum in the treatment T₁₀ and followed by T₃ (7.33cm), T₁₁ (6.67cm) and T₄(6.67cm). However, minimum was recorded in T₀ (3.33cm).

Plant height after 6 month (9.00cm) was observed maximum in T₁₀ and followed by T₃ (8.67cm), T₁₁ (7.67cm) and T₄ (7.33cm). However, minimum was recorded in T₀ (3.67cm).

Plant height after 9 month (16.17cm) was observed maximum in T₁₀ and followed by T₃ (16.00cm), T₁₁ (15.87cm) and T₄ (15.83cm) However, minimum was recorded in T₀ (7.33cm).

Plant height after 12 month (20.00cm) was observed maximum in T₁₀ and followed by T₃ (29.00cm), T₁₁ (23.13cm) and T₄ (21.97cm). However, minimum was recorded in T₀ (10.83cm). Other organic manure and irrigation schedule showed the significant difference in the plant height in all monthly treatment of first year.

The Plant height during second year (Table 4.14.1.) -

The results of the average plant height after 3 month (12.33cm) was observed maximum in the treatment T₁₀ and followed by T₃ (10.33cm), T₁₁ (7.00cm) and T₄ (6.67cm). However, minimum was recorded in T₀ (3.33cm).

Plant height after 6 month (19.67cm) was observed maximum in T₁₀ and followed by T₃ (16.67cm), T₁₁ (12.67cm) and T₄ (12.33cm). However, minimum was recorded in T₀ (4.70cm).

Plant height after 9 month (25.27cm) was observed maximum in T₁₀ and followed by T₃ (24.33cm), T₁₁ (24.27cm) and T₄ (23.33cm). However, minimum was recorded in T₀ (9.90cm).

Plant height after 12 month (28.67cm) was observed maximum in T₁₀ and followed by T₃ (26.34cm), T₁₁ (25.77cm) and T₄ (25.34cm). However, minimum was recorded in T₀ (18.00cm). Other organic manure and irrigation schedule showed the significant difference in the plant height in all monthly treatment of second year.

Table 4.14.1. Increase in plant height (cm) of one year old seedlings of Karanj (*Pongamia pinnata*) at Usar site at different intervals (Year-wise)

Treatment No.	Treatment		Increase in plant height (cm) of Karanj - one year old seedlings - Usar site									
			December, 2011 to November, 2012					December, 2012 to November, 2013				
			3 months	6 months	9 months	12 months	Total	3 months	6 months	9 months	12 months	Total
T ₀	Control		3.33	3.67	7.33	10.83	25.16	3.33	4.70	9.90	18.00	35.93
T ₁	FYM	When required	5.67	7.33	15.43	21.87	50.30	6.00	11.67	22.33	23.00	63.00
T ₂	NC	When required	5.33	6.67	14.03	19.77	45.80	5.67	11.33	21.67	22.34	61.01
T ₃	VC	When required	7.33	8.67	16.00	29.00	61.00	10.33	16.67	24.33	26.34	77.67
T ₄	FYM	10 Days	6.67	7.33	15.83	21.97	51.80	6.67	12.33	23.33	25.34	67.67
T ₅	FYM	20 Days	5.33	6.67	14.33	20.00	46.33	5.80	11.33	21.97	22.55	61.65
T ₆	FYM	30 Days	4.33	5.00	9.93	16.00	35.26	5.00	7.30	16.27	21.33	49.90
T ₇	NC	10 Days	5.33	6.33	13.67	19.57	44.90	5.67	10.33	20.00	22.34	58.34
T ₈	NC	20 Days	4.67	5.67	12.10	18.33	40.77	5.67	9.67	19.95	21.34	56.63
T ₉	NC	30 Days	3.33	3.67	7.33	10.83	25.16	3.33	4.70	9.90	18.00	35.93
T ₁₀	VC	10 Days	8.67	9.00	16.17	20.00	53.84	12.33	19.67	25.27	28.67	85.94
T ₁₁	VC	20 Days	6.67	7.67	15.87	23.13	53.34	7.00	12.67	24.27	25.77	69.71
T ₁₂	VC	30 Days	4.00	5.00	9.10	15.33	33.43	3.33	6.33	11.00	19.53	40.19
		F- test	S	S	S	S		S	S	S	S	
		S. Ed. (±)	0.13	0.13	0.10	1.89		0.50	1.09	2.05	3.57	
		C. D. (P = 0.05)	0.27	0.27	0.20	3.91		1.04	2.25	4.23	7.36	

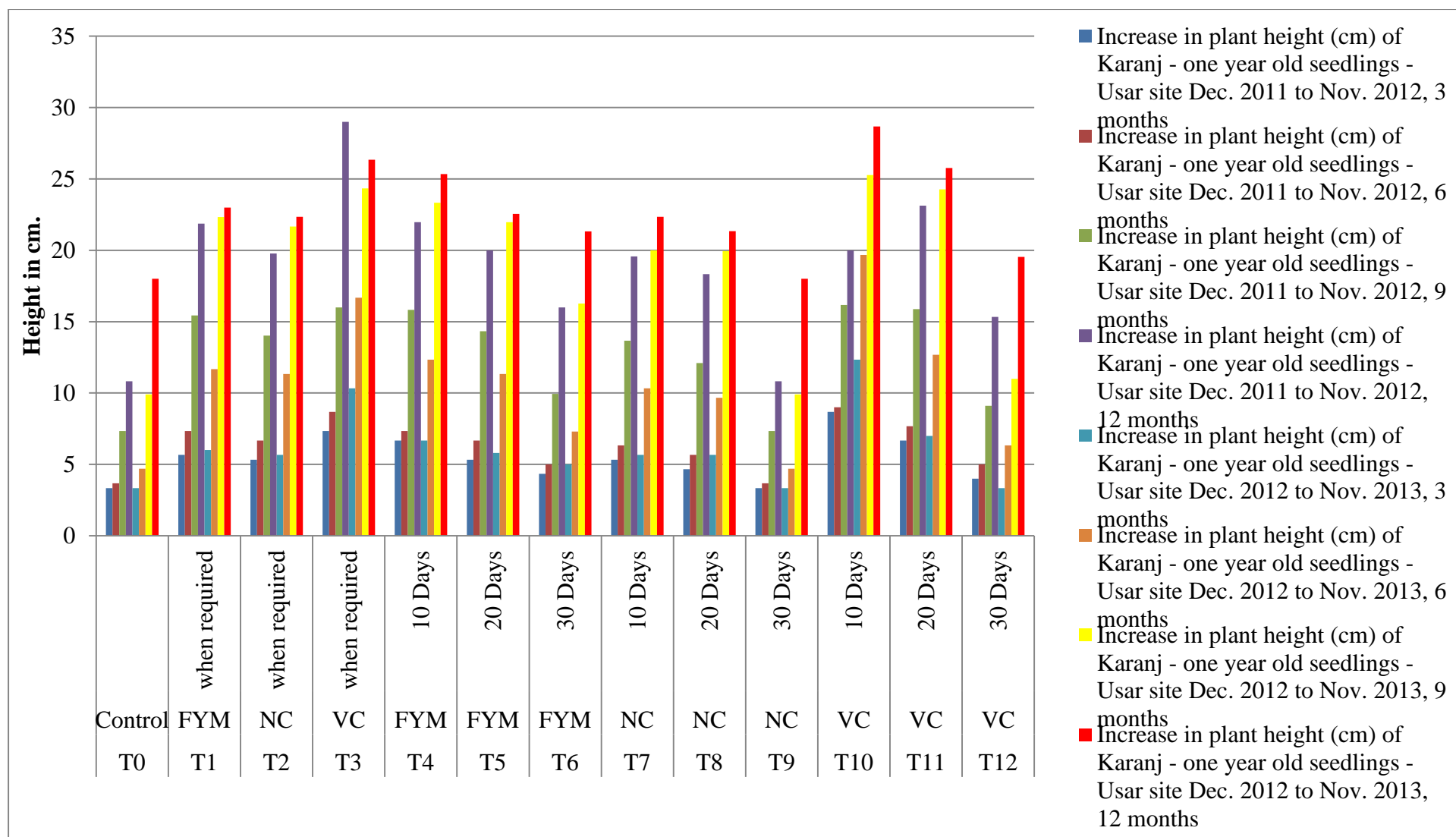


Fig 4.14.1. Increase in plant height (cm) of one year old seedling of Karanj at Usar site in December, 2011 to November, 2013.

4.14.2. Increase in Collar diameter (cm) of one year old seedling of *Pongamia pinnata* (Karanj) at Usar site in December, 2011 to November, 2012 and December, 2012 to November, 2013.

The Plant Collar diameter during first year (Table 4.14.2.) -

The results of the average Collar diameter after 3 month (0.67cm) was observed maximum in the treatment T₁₀ and followed by T₃ (0.67cm), T₁₁ (0.66cm) and T₄ (0.58cm), However, minimum increase Collar diameter was recorded in T₀ (0.31cm).

Collar diameter after 6 month (1.20cm) was observed maximum in T₁₀ and followed by T₃ (0.67cm), T₁₁ (0.63cm) and T₄ (0.52cm). However, minimum increase Collar diameter was recorded in T₀ (0.21cm).

Collar diameter after 9 month (1.90cm) was observed maximum in T₁₀ and followed by T₃ (1.53cm), T₁₁ (1.30cm) and T₄ (1.20cm). However, minimum increase Collar diameter was recorded in T₀ (0.60cm).

Collar diameter after 12 month (2.10cm) was observed maximum in T₁₀ and followed by T₃ (1.60cm), T₁₁ (1.42cm) and T₄ (1.34cm). However, minimum increase Collar diameter was recorded in T₀ (0.74cm). Other organic manure and irrigation schedule showed the significant difference in the plant Collar diameter in all monthly treatment of first year.

The Plant Collar diameter during second year (Table 4.14.2.) -

The results of the average Collar diameter after 3 month (0.62cm) was observed maximum in the treatment T₁₀ and followed by T₃ (0.50cm), T₁₁ (0.47cm) and T₄ (0.41cm). However, minimum increase Collar diameter was recorded in T₀ (0.14cm).

The results of the average Collar diameter after 6 month (1.75cm) was observed maximum in T₁₀ and followed by T₃ (1.65cm), T₁₁ (1.45cm) and T₄ (1.42cm). However, minimum increase Collar diameter was recorded in T₀ (0.65cm).

The results of the average Collar diameter after 9 month (2.00cm) was observed maximum in T₁₀ and followed by T₃ (1.87cm), T₁₁ (1.50cm) and T₄ (1.50cm). However, minimum increase Collar diameter was recorded in T₀ (1.10cm).

Collar diameter after 12 month (1.65cm) was observed maximum in T₁₀ and followed by T₃ (1.60cm), T₁₁ (1.50cm) and T₄ (1.50cm). However, minimum increase Collar diameter was recorded in T₀ (1.18cm). Other organic manure and irrigation schedule showed the significant difference in the plant Collar diameter in all monthly treatment of second year.

Table 4.14.2. Increase in collar diameter (cm) of one year old seedlings of Karanj (*Pongamia pinnata*) at Usar site at different intervals (Year-wise)

Treatment No.	Treatment		Increase in collar diameter (cm) of Karanj - one year old seedlings - Usar site									
			December, 2011 to November, 2012					December, 2012 to November, 2013				
	Organic manure	Irrigation schedule	3 months	6 months	9 months	12 months	Total	3 months	6 months	9 months	12 months	Total
T ₀	Control		0.31	0.21	0.60	0.74	1.86	0.14	0.65	1.10	1.18	3.07
T ₁	FYM	When required	0.50	0.50	1.10	1.32	3.42	0.40	1.32	1.62	1.49	4.83
T ₂	NC	When required	0.42	0.43	1.00	1.20	3.05	0.38	1.10	1.55	1.41	4.44
T ₃	VC	When required	0.67	0.67	1.53	1.60	4.47	0.50	1.65	1.87	1.60	5.62
T ₄	FYM	10 Days	0.58	0.52	1.20	1.34	3.64	0.41	1.42	1.64	1.50	4.97
T ₅	FYM	20 Days	0.42	0.50	1.00	1.22	3.14	0.40	1.10	1.56	1.44	4.50
T ₆	FYM	30 Days	0.42	0.32	0.62	0.89	2.25	0.21	0.72	1.32	1.22	3.47
T ₇	NC	10 Days	0.42	0.41	0.91	0.90	2.64	0.32	1.10	1.52	1.27	4.21
T ₈	NC	20 Days	0.42	0.40	0.89	0.90	2.61	0.30	0.78	1.42	1.24	3.74
T ₉	NC	30 Days	0.32	0.21	0.60	0.74	1.87	0.17	0.65	1.10	1.18	3.10
T ₁₀	VC	10 Days	0.67	1.20	1.90	2.10	5.87	0.62	1.75	2.00	1.65	6.02
T ₁₁	VC	20 Days	0.66	0.63	1.30	1.42	4.01	0.47	1.45	1.74	1.50	5.16
T ₁₂	VC	30 Days	0.35	0.23	0.62	0.78	1.98	0.17	0.70	1.30	1.21	3.38
		F- test	S	S	S	S		S	S	S	S	
		S. Ed. (\pm)	0.05	0.09	0.18	0.24		0.11	0.38	0.26	0.23	
		C. D. (P = 0.05)	0.10	0.19	0.36	0.50		0.23	0.78	0.54	0.48	

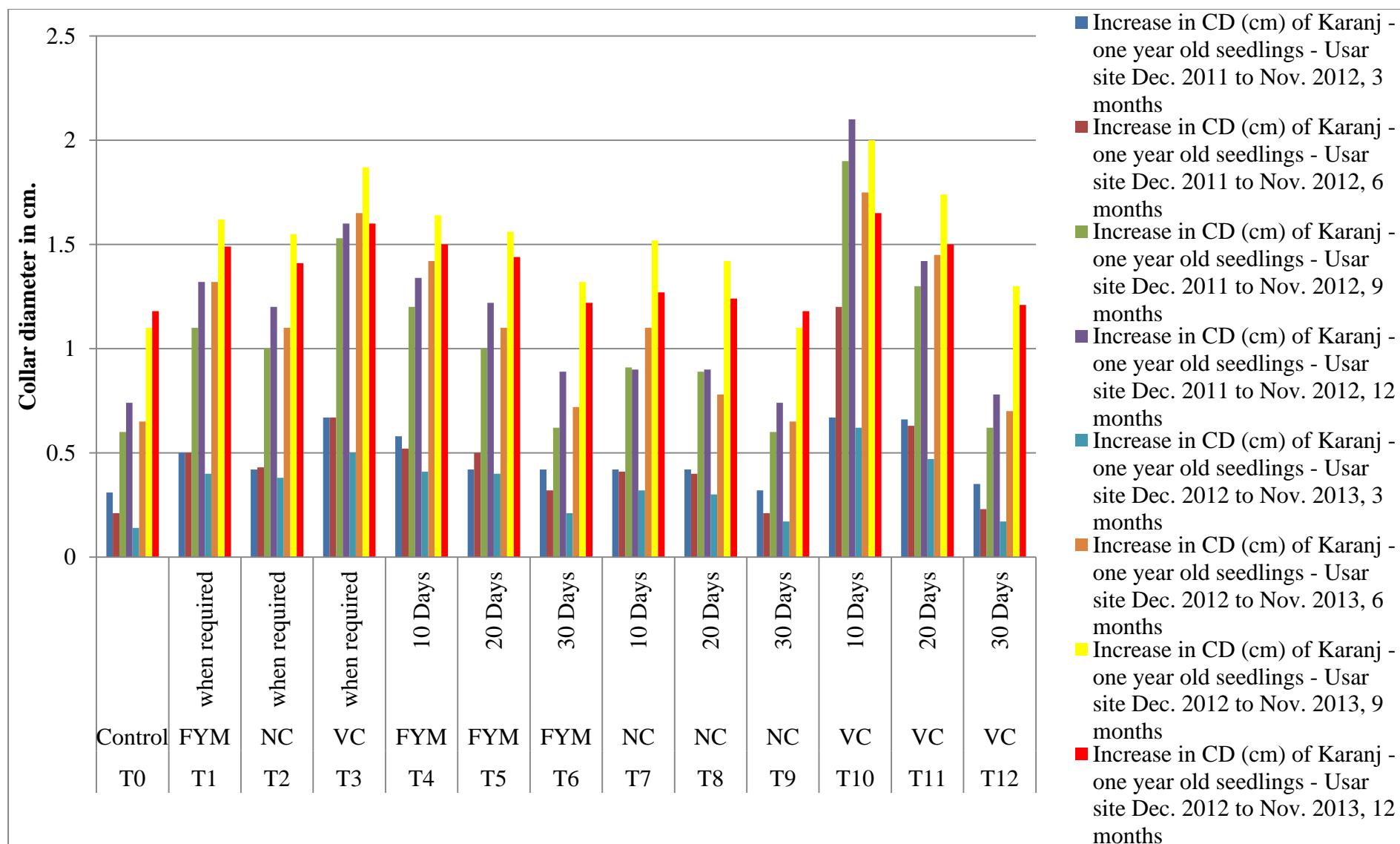


Fig.4.14.2. Increase in Collar diameter (cm) of one year old seedling of Karanj at Usar site in December, 2011 to November, 2013.

4.14.3. Survival percentage of one year old seedling of *Pongamia pinnata* (Karanj) at Usar site at different intervals in December, 2011 to November, 2012 and December, 2012 to November, 2013.

The Plant Survival percentage during first year (Table 4.14.3.) -

The survivality in first year of 3, 6 and 9 month reported Karanj seedlings grown at Usar sites with different intervals of irrigation schedule along with the applications of organic manures available or provide in a form of different treatment combinations.

The study clearly indicates non significant maximum survival percentage i. 100% was found in T₀, T₁, T₂, T₃, T₄ T₅, T₆, T₇, T₈, T₉, T₁₀, T₁₁ and T₁₂ treatment.

The survivality in first year of 12 month reported Karanj seedlings grown at Usar sites with different intervals of irrigation schedule along with the applications of organic manures available or provide in a form of different treatment combinations.

The study clearly indicates non significant maximum survival percentage i.e. 100% was found in T₁, T₂, T₃, T₄ T₅, T₆, T₇, T₈, T₁₀ T₁₁, and T₁₂ due to good soil condition, nature of soil fertility availability essential minerals & nutrients, proper and good health condition of Karanj seedlings and its adaptability. This followed T₀ and T₉ with 66.67% which shows minimum survival percentage of Karanj seedlings because of some deficiencies are found present in Usar site with decrease physical properties of soil. Overall it is observed that treatment T₁₀ (vermicompost @ 10 days of irrigation schedule) with maximum survivality or survival % i.e. 100@ along with other attributes or observatory parameters would consider the best treatment combination.

The Plant Survival percentage during second year (Table 4.14.3.) -

The survivality in second year of 3 month reported Karanj seedlings grown at Usar sites with different intervals of irrigation schedule along with the applications of organic manures available or provide in a form of different treatment combinations.

The study clearly indicates non significant maximum survival percentage i.e. 100% was found in T₁, T₂, T₃, T₄ T₅, T₆, T₇, T₈, T₁₀, T₁₁ and T₁₂, due to good soil condition, nature of soil fertility availability essential minerals & nutrients, proper and good health condition of Karanj seedlings and its adaptability. This followed T₀ and T₉ with 66.67%

which shows minimum survival percentage of Karanj seedlings because of some deficiencies are found present in Usar site with decrease physical properties of soil. Overall it is observed that treatment T₁₀ (vermicompost @ 10 days of irrigation schedule) with maximum survivality or survival % i.e. 100@ along with other attributes or observatory parameters would consider the best treatment combination.

The survivality in second year of 6, 9 and 12 month reported Karanj seedlings grown at Usar sites with different intervals of irrigation schedule along with the applications of organic manures available or provide in a form of different treatment combinations.

The study clearly indicates significant maximum survival percentage i.e. 100% was found in T₁, T₂, T₃, T₄ T₅, T₆, T₇, T₈, T₁₀, T₁₁ and T₁₂ due to good soil condition, nature of soil fertility availability essential minerals & nutrients, proper and good health condition of Karanj seedlings and its adaptability. This followed T₉ with 66.67% and treatment T₀ (control) which shows (33.33%) minimum survival percentage of Karanj seedlings because of some deficiencies are found present in Usar site or decrease in physical nature of soil. Overall it is observed that treatment T₁₀ (vermicompost @ 10 days of irrigation schedule) with maximum survivality or survival % i.e. 100@ along with other attributes or observatory parameters would consider the best treatment combination.

Table 4.14.3. Survival percentage of one year old seedlings of Karanj (*Pongamia pinnata*) at Usar site at different intervals (Year-wise)

Treatment No.	Treatment		Survival percentage of Karanj - one year old seedlings - Usar site									
			December, 2011 to November, 2012					December, 2012 to November, 2013				
			3 months	6 months	9 months	12 months	Total	3 months	6 months	9 months	12 months	Total
T ₀	Control		100.00	100.00	100.00	66.67	66.67	66.67	33.33	33.33	33.33	33.33
T ₁	FYM	When required	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₂	NC	When required	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₃	VC	When required	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₄	FYM	10 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₅	FYM	20 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₆	FYM	30 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₇	NC	10 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₈	NC	20 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₉	NC	30 Days	100.00	100.00	100.00	66.67	66.67	66.67	66.67	66.67	66.67	66.67
T ₁₀	VC	10 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₁₁	VC	20 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₁₂	VC	30 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
		F- test	NS	NS	NS	NS		NS	S	S	S	
		S. Ed. (\pm)	-	-	-	-		-	18.10	18.10	18.10	
		C. D. (P = 0.05)	-	-	-	-		-	37.36	37.36	37.36	

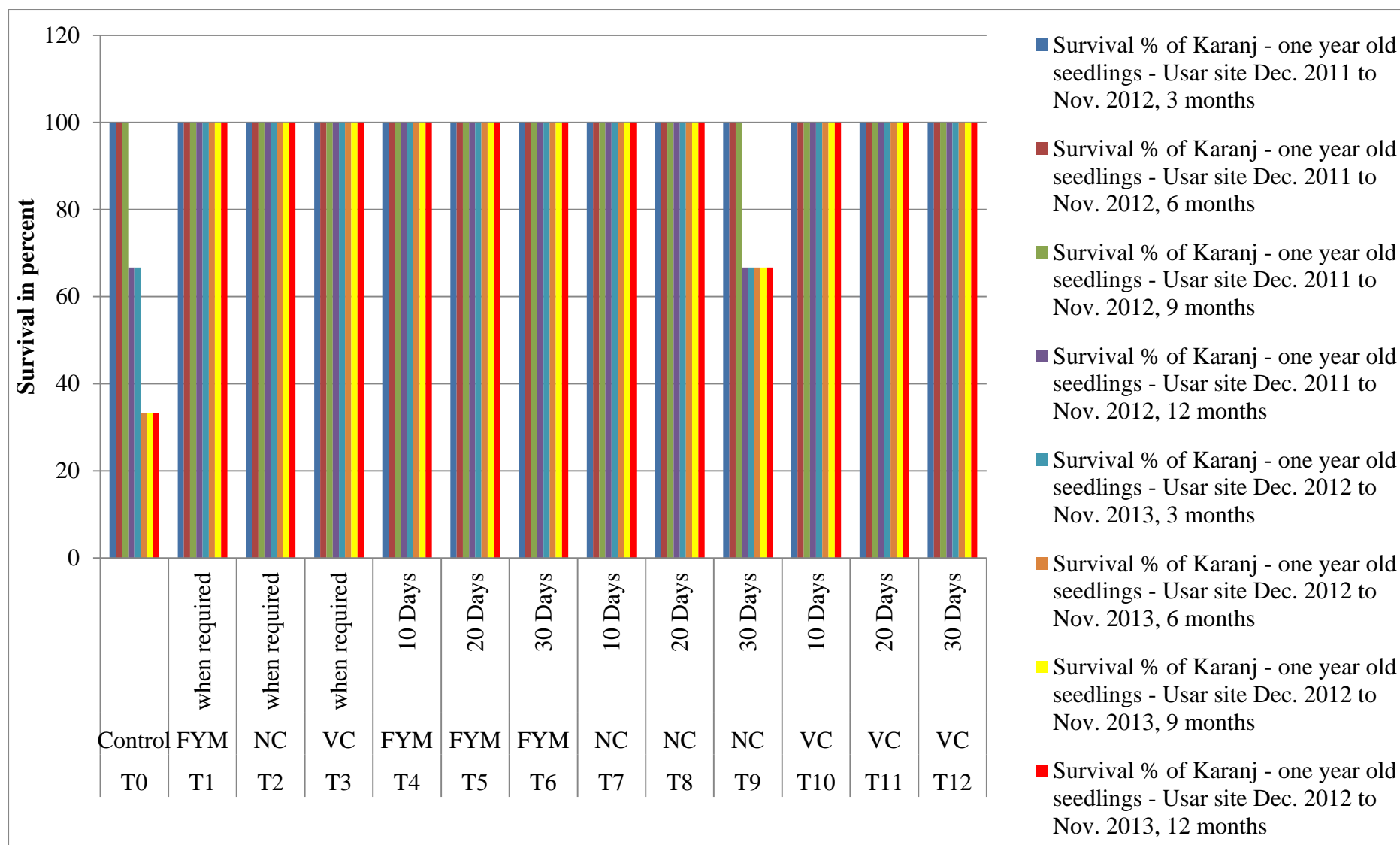


Fig. 4.14.3. Increase in Collar diameter (cm) of one year old seedling of Karanj at Usar site in December, 2011 to November, 2013.

4.15. Two year old seedling plantation of *Pongamia pinnata* (Karanj) at Usar site:

4.15.1. Increase in plant height (cm) of two year old seedling of *Pongamia pinnata* (Karanj) at Usar site in December, 2011 to November, 2012 and December, 2012 to November, 2013.

The Plant height during first year (Table 4.15.3.) -

The results of the average plant height after 3 month (8.33cm) was observed maximum in the treatment T₁₀ followed T₃ (7.33cm), T₁₁ (7.00cm) and T₄ (6.67cm), However, minimum was recorded in T₀ (4.67cm).

Plant height after 6 month (8.67cm) was observed maximum in T₁₀ and followed by T₃ (8.33cm), T₁₁ (8.00cm) and T₄ (7.67cm). However, minimum was recorded in T₀ (4.67cm).

Plant height after 9 month (18.33cm) was observed maximum in T₁₀ and followed by T₃ (17.00cm), T₁₁ (15.33cm) and T₄ (14.67cm). However, minimum was recorded in T₀ (8.33cm).

Plant height after 12 month (30.00cm) was observed maximum in T₁₀ and followed by T₃(27.33cm), T₁₁(26.33cm) and T₄(26.00cm). However, minimum was recorded in T₀ (13.00cm). Other organic manure and irrigation schedule showed the significant difference in the plant height in all monthly treatment of first year.

Plant height after 3 month (9.67cm) was observed maximum in the treatment T₁₀ and followed by T₃ (9.33cm), T₁₁ (8.67cm) and T₄ (7.67cm), However, minimum was recorded in T₀ (2.33cm).

Plant height after 6 month (15.00cm) was observed maximum in T₁₀ and followed by T₃ (14.67cm), T₁₁ (12.00cm) and T₄ (12.00cm). However, minimum was recorded in T₀ (4.33cm).

Plant height after 9 month (30.00cm) was observed maximum in T₁₀ and followed by T₃ (27.33cm), T₁₁ (26.00cm) and T₄ (25.67cm). However, minimum was recorded in T₀ (13.00cm).

Plant height after 12 month (36.33cm) was observed maximum in T₁₀ and followed by T₃ (34.33cm), T₁₁ (30.67cm) and T₄ (28.70cm). However, minimum was

recorded in T₀ (17.00cm). Other organic manure and irrigation schedule showed the significant difference in the plant height in all monthly treatment of second year.

Table 4.15.1. Increase in plant height (cm) of two years old seedlings of Karanj (*Pongamia pinnata*) at Usar site at different intervals (Year-wise)

Treatment No.	Treatment		Increase in plant height (cm) of Karanj - two years old seedlings - Usar site									
			December, 2011 to November, 2012					December, 2012 to November, 2013				
			3 months	6 months	9 months	12 months	Total	3 months	6 months	9 months	12 months	Total
T ₀	Control		4.67	4.67	8.33	13.00	30.67	2.33	4.33	13.00	17.00	36.66
T ₁	FYM	When required	6.67	7.67	14.33	25.00	53.67	7.33	11.33	25.00	28.67	72.33
T ₂	NC	When required	6.33	7.00	13.00	22.33	48.66	6.00	8.00	22.33	26.33	62.66
T ₃	VC	When required	7.33	8.33	17.00	27.33	59.99	9.33	14.67	27.33	34.33	85.66
T ₄	FYM	10 Days	6.67	7.67	14.67	26.00	55.01	7.67	12.00	25.67	28.70	74.04
T ₅	FYM	20 Days	6.35	7.33	14.33	23.90	51.91	6.33	10.00	23.90	26.33	66.56
T ₆	FYM	30 Days	5.67	5.33	10.00	16.37	37.37	4.00	6.33	20.00	21.33	51.66
T ₇	NC	10 Days	6.33	7.00	12.67	21.00	47.00	4.65	8.00	21.00	24.67	58.32
T ₈	NC	20 Days	6.00	7.00	10.33	20.95	44.28	4.00	7.00	20.95	22.33	54.28
T ₉	NC	30 Days	4.67	4.67	8.33	13.00	30.67	2.33	4.33	13.00	17.00	36.66
T ₁₀	VC	10 Days	8.33	8.67	18.33	30.00	65.33	9.67	15.00	30.00	36.33	91.00
T ₁₁	VC	20 Days	7.00	8.00	15.33	26.33	56.66	8.67	12.00	26.00	30.67	77.34
T ₁₂	VC	30 Days	5.67	5.00	10.60	15.00	36.27	3.00	5.33	16.37	20.67	45.37
		F- test	S	S	S	S		S	S	S	S	
		S. Ed. (±)	1.29	1.31	2.46	3.71		0.76	1.68	4.40	5.30	
		C. D. (P = 0.05)	2.67	2.70	5.07	7.65		1.56	3.46	9.07	10.94	

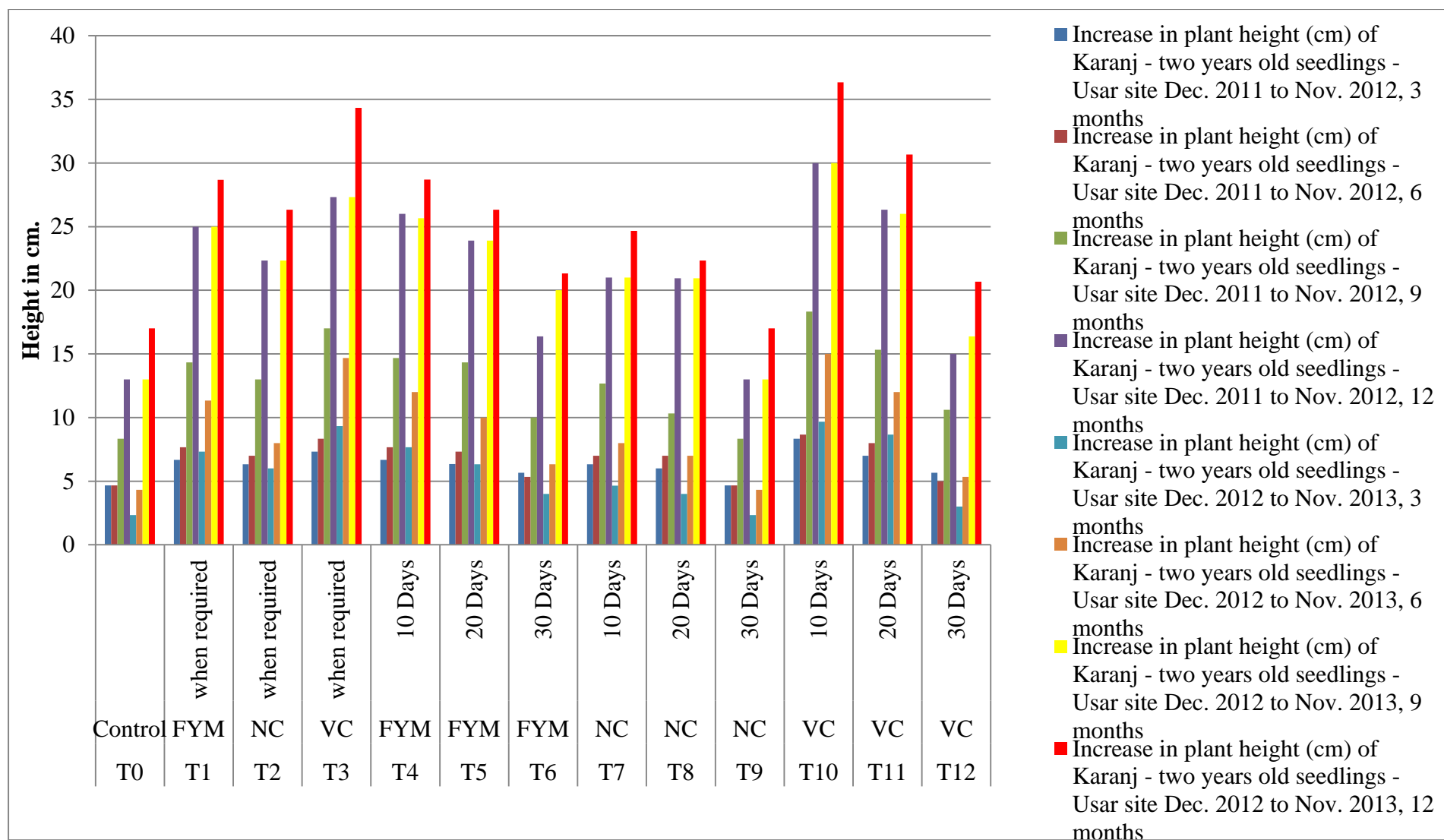


Fig. 4.15.1. Increase in plant height (cm) of two year old seedling of Karanj at Usar site in December, 2011 to November, 2013.

4.15.2. Increase in Collar diameter (cm) of two year old seedling of *Pongamia pinnata* (Karanj) at Usar site in December, 2011 to November, 2012 and December, 2012 to November, 2013.

The Plant Collar diameter during first year (Table 4.15.2.) -

The results of the average Collar diameter after 3 month (0.84cm) was observed maximum in the treatment T_{10} and followed by T_3 (0.67cm), T_{11} (0.66cm) and T_4 (0.66cm), However, minimum increase Collar diameter was recorded in T_0 (0.21cm).

Collar diameter after 6 month (1.85cm) was observed maximum in T_{10} and followed by T_3 (1.42cm), T_{11} (1.33cm) and T_4 (1.33cm). However, minimum increase Collar diameter was recorded in T_0 (0.42cm).

Collar diameter after 9 month (2.40cm) was observed maximum in T_{10} and followed by T_3 (2.20cm), T_{11} (2.00cm) and T_4 (2.00cm). However, minimum increase Collar diameter was recorded in T_0 (1.40cm).

Collar diameter after 12 month (2.65cm) was observed maximum in T_{10} and followed by T_3 (2.45cm), T_{11} (2.45cm) and T_4 (2.40cm). However, minimum increase Collar diameter was recorded in T_0 (1.13cm). Other organic manure and irrigation schedule showed the significant difference in the plant Collar diameter in all monthly treatment of first year.

The Plant Collar diameter during second year (Table 4.15.2.) -

The results of the average Collar diameter after 3 month (1.32cm) was observed maximum in the treatment T_{10} and followed by T_3 (1.10cm), T_{11} (1.00cm) and T_4 (0.98cm), However, minimum increase Collar diameter was recorded in T_0 (0.28cm).

The results of the average Collar diameter after 6 month (1.89cm) was observed maximum in T_{10} and followed by T_3 (1.87cm), T_{11} (1.87cm) and T_4 (1.78cm). However, minimum increase Collar diameter was recorded in T_0 (1.10cm).

Collar diameter after 9 month (2.52cm) was observed maximum in T_{10} and followed by T_3 (2.45cm), T_{11} (2.35cm) and T_4 (2.32cm). However, minimum increase Collar diameter was recorded in T_0 (1.00cm).

Collar diameter after 12 month (2.59cm) was observed maximum in T₁₀ and followed by T₃ (2.50cm), T₁₁ (2.03cm) and T₄ (2.03cm). However, minimum increase Collar diameter was recorded in T₀ (1.55cm). Other organic manure and irrigation schedule showed the significant difference in the plant Collar diameter in all monthly treatment of second year.

Table 4.15.2. Increase in collar diameter (cm) of two years old seedlings of Karanj (*Pongamia pinnata*) at Usar site at different intervals (Year-wise)

Treatment No.	Treatment		Increase in collar diameter (cm) of Karanj - two years old seedlings - Usar site									
			December, 2011 to November, 2012					December, 2012 to November, 2013				
	Organic manure	Irrigation schedule	3 months	6 months	9 months	12 months	Total	3 months	6 months	9 months	12 months	Total
T ₀	Control		0.21	0.42	1.40	1.13	3.16	0.28	1.10	1.00	1.55	3.93
T ₁	FYM	When required	0.52	1.17	2.00	2.32	6.01	0.87	1.69	2.21	2.00	6.77
T ₂	NC	When required	0.42	1.00	1.87	2.14	5.43	0.78	1.63	2.15	1.90	6.46
T ₃	VC	When required	0.67	1.42	2.20	2.45	6.74	1.10	1.87	2.45	2.50	7.92
T ₄	FYM	10 Days	0.66	1.33	2.00	2.40	6.39	0.98	1.78	2.32	2.03	7.11
T ₅	FYM	20 Days	0.50	1.00	1.89	2.20	5.59	0.87	1.68	2.20	1.99	6.73
T ₆	FYM	30 Days	0.32	0.65	1.62	1.68	4.27	0.35	1.45	1.68	1.64	5.11
T ₇	NC	10 Days	0.42	0.86	1.80	2.10	5.18	0.68	1.56	2.11	1.85	6.20
T ₈	NC	20 Days	0.33	0.83	1.78	1.78	4.72	0.56	1.54	1.78	1.80	5.68
T ₉	NC	30 Days	0.24	0.42	1.40	1.13	3.19	0.30	1.10	1.00	1.57	3.97
T ₁₀	VC	10 Days	0.84	1.85	2.40	2.65	7.74	1.32	1.89	2.52	2.59	8.32
T ₁₁	VC	20 Days	0.66	1.33	2.00	2.45	6.44	1.00	1.87	2.35	2.03	7.25
T ₁₂	VC	30 Days	0.25	0.52	1.62	1.32	3.71	0.35	1.43	1.21	1.59	4.58
		F- test	S	S	S	S		S	S	S	S	
		S. Ed. (±)	0.09	0.25	0.54	0.55		0.21	0.30	0.40	0.43	
		C. D. (P = 0.05)	0.18	0.51	1.10	1.13		0.43	0.61	0.83	0.89	

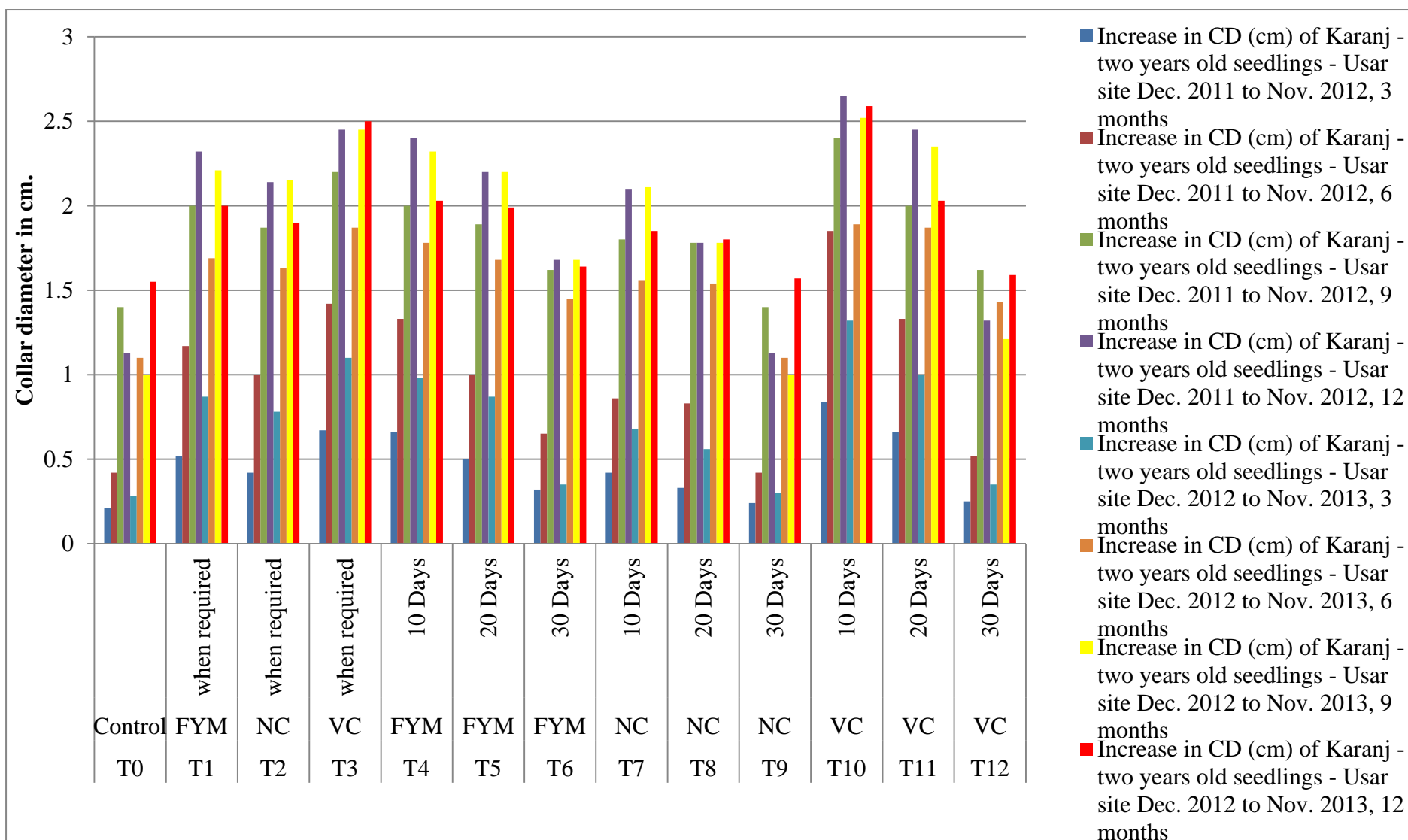


Fig. 4.15.2. Increase in Collar diameter (cm) of two year old seedling of Karanj at Usar site in December, 2011 to November, 2013.

4.15.3. Survival percentage of two year old seedling of *Pongamia pinnata* (Karanj) at Usar site at different intervals in December, 2011 to November, 2012 and December, 2012 to November, 2013.

The Plant Survival percentage during first year (Table 4.15.3.) -

The survivability in first year of 3 month reported Karanj seedlings grown at Usar sites with different intervals of irrigation schedule along with the applications of organic manures available or provide in a form of different treatment combinations.

The study clearly indicates non significant maximum survival percentage i.e. 100% was found in T₁, T₂, T₃, T₄ T₅, T₇, T₈, T₁₀ and T₁₁, due to good soil condition, nature of soil fertility availability essential minerals & nutrients, proper and good health condition of Karanj seedlings and its adaptability. This followed T₀, T₆, T₉ and T₁₂ with 66.67% which shows minimum survival percentage of Karanj seedlings.

The survivability in first year of 9 and 12 month reported Karanj seedlings grown at Usar sites with different intervals of irrigation schedule along with the applications of organic manures available or provide in a form of different treatment combinations. s

The study clearly indicates significant maximum survival percentage i.e. 100% was found in T₁, T₂, T₃, T₄ T₅, T₇, T₈, T₁₀, and T₁₁ due to good soil condition, nature of soil fertility availability essential minerals & nutrients, proper and good health condition of Karanj seedlings and its adaptability and followed by T₆, T₉, T₁₂ with 66.67% and treatment T₀ (control) which shows (33.33%) minimum survival percentage of Karanj seedlings because of some deficiencies are found present in Usar site or decrease in physical nature of soil. Overall it is observed that treatment T₁₀ (vermicompost @ 10 days of irrigation schedule) with maximum survivability or survival % i.e. 100@ along with other attributes or observatory parameters would consider the best treatment combination.

The Plant Collar diameter during first year (Table 4.15.3.) -

The survivability in second year of 3, 6, 9 and 12 month reported Karanj seedlings grown at Usar sites with different intervals of irrigation schedule along with the applications of organic manures available or provide in a form of different treatment combinations.

The study clearly indicates significant maximum survival percentage i.e. 100% was found in T₁, T₂, T₃, T₄, T₅, T₇, T₈, T₁₀, and T₁₁ due to good soil condition, nature of soil fertility availability essential minerals & nutrients, proper and good health condition of Karanj seedlings and its adaptability. This followed T₆, T₉ and T₁₂ with 66.67% and treatment T₀ (control) which shows (33.33%) minimum survival percentage of Karanj seedlings because of some deficiencies are found present in Usar site or decrease in physical nature of soil. Overall it is observed that treatment T₁₀ (vermicompost @ 10 days of irrigation schedule) with maximum survivality or survival % i.e. 100@ along with other attributes or observatory parameters would consider the best treatment combination.

Table 4.15.3. Survival percentage of two years old seedlings of Karanj (*Pongamia pinnata*) at Usar site at different intervals (Year-wise)

Treatment No.	Treatment		Survival percentage of Karanj - two years old seedlings - Usar site									
			December, 2011 to November, 2012					December, 2012 to November, 2013				
			3 months	6 months	9 months	12 months	Total	3 months	6 months	9 months	12 months	Total
T ₀	Control		66.67	66.67	33.33	33.33	33.33	33.33	33.33	33.33	33.33	33.33
T ₁	FYM	When required	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₂	NC	When required	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₃	VC	When required	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₄	FYM	10 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₅	FYM	20 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₆	FYM	30 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₇	NC	10 Days	66.67	66.67	66.67	66.67	66.67	66.67	66.67	66.67	66.67	66.67
T ₈	NC	20 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₉	NC	30 Days	66.67	66.67	66.67	66.67	66.67	66.67	66.67	66.67	66.67	66.67
T ₁₀	VC	10 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₁₁	VC	20 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₁₂	VC	30 Days	66.67	66.67	66.67	66.67	66.67	66.67	66.67	66.67	66.67	66.67
		F- test	NS	NS	NS	NS		NS	NS	NS	NS	
		S. Ed. (\pm)	-	-	-	-		-	-	-	-	
		C. D. (P = 0.05)	-	-	-	-		-	-	-	-	

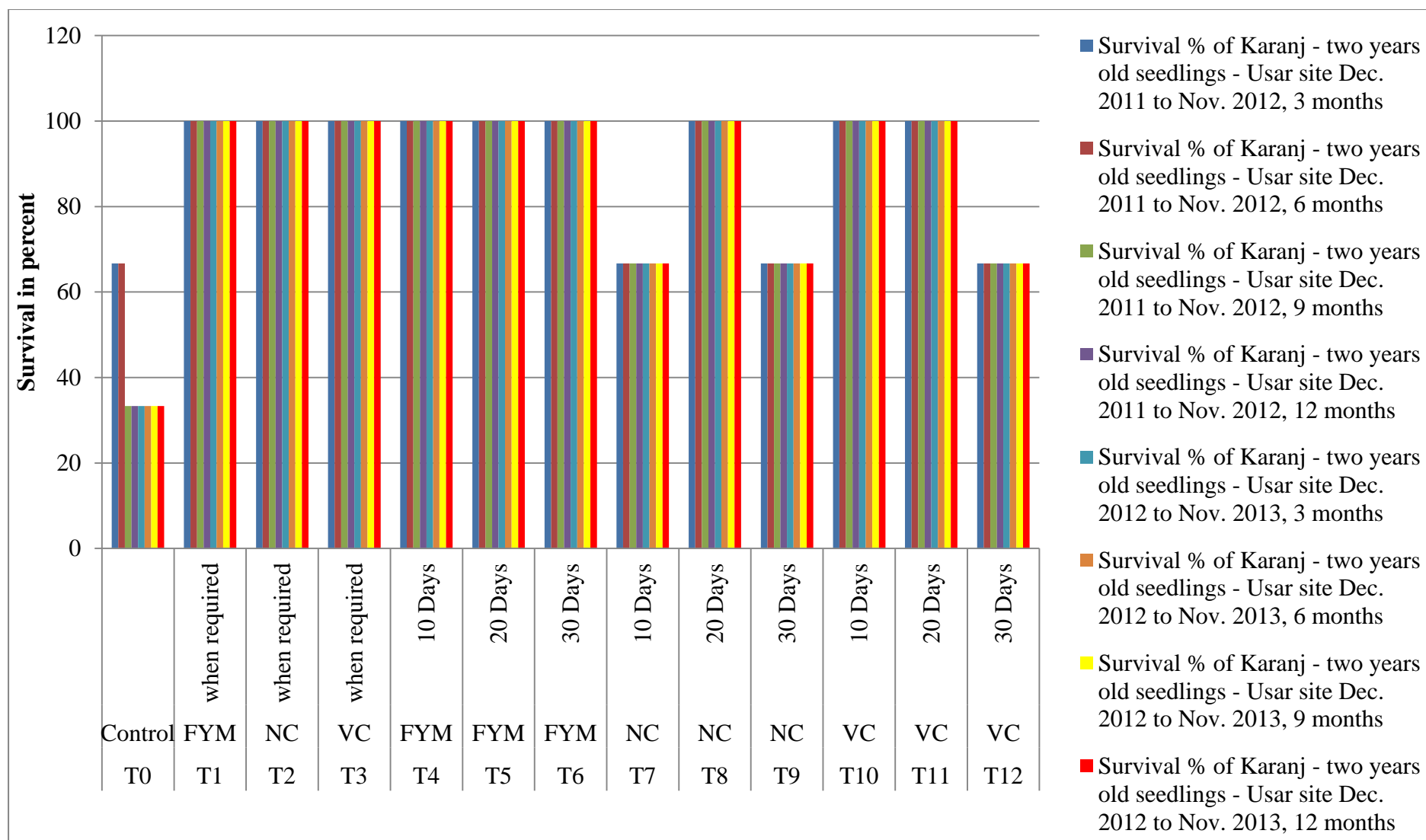


Fig. 4.15.3. Survival percentage of two year old seedling of Karanj at Usar site in December, 2011 to November, 2013.

4.16. Six month old seedling plantation of *Emblica officinalis* (Aonla) at Usar site:

4.16.1. Increase in plant height (cm) of six month old seedling of *Emblica officinalis* (Aonla) at Usar site in December, 2011 to November, 2012 and December, 2012 to November, 2013.

The Plant height during first year (Table 4.16.1.) -

The results of the average plant height after 3 month (1.10cm) was observed maximum in the treatment T_{10} and followed by T_3 (1.10cm), T_{11} (0.90cm) and T_4 (0.90cm). However, minimum was recorded in T_0 (0.30cm).

Plant height after 6 month (1.90cm) was observed maximum in T_{10} and followed by T_3 (1.67cm), T_{11} (1.60cm) and T_4 (1.37cm). However, minimum was recorded in T_0 (0.40cm).

Plant height after 9 month (9.14cm) was observed maximum in T_{10} and followed by T_3 (8.87cm), T_{11} (8.40cm) and T_4 (8.03cm). However, minimum was recorded in T_0 (3.50cm).

Plant height after 12 month (10.93cm) was observed maximum in T_{10} and followed by T_3 (10.17cm), T_{11} (9.97cm) and T_4 (9.17cm). However, minimum was recorded in T_0 (2.40cm). Other organic manure and irrigation schedule showed the significant difference in the plant height in all monthly treatment of first year.

The Plant height during second year (Table 4.16.1.) -

The results of the average plant height after 3 month (1.87cm) was observed maximum in the treatment T_{10} and followed by T_3 (1.71cm), T_{11} (1.56cm) and T_4 (1.28cm). However, minimum was recorded in T_0 (0.50cm).

Plant height after 6 month (1.83cm) was observed maximum in T_{10} and followed by T_3 (1.67cm), T_{11} (1.60cm) and T_4 (1.40cm). However, minimum was recorded in T_0 (0.68cm).

Plant height after 9 month (15.27cm) was observed maximum in T_{10} and followed by T_3 (13.57cm), T_{11} (12.83cm) and T_4 (11.83cm). However, minimum was recorded in T_0 (2.20cm).

The results of the average plant height after 12 month (13.87cm) was observed maximum in T_{10} and followed by T_3 (12.50cm), T_{11} (12.10cm) and T_4 (11.37cm). However, minimum was recorded in T_0 (0.80cm). Other organic manure and irrigation schedule showed the significant difference in the plant height in all monthly treatment of second year.

Table 4.16.1. Increase in plant height (cm) of six months old seedlings of Aonla (*Emblica officinalis*) at Usar site at different intervals (Year-wise)

Treatment No.	Treatment		Increase in plant height (cm) of Aonla - 6 months old seedlings - Usar site									
	Organic manure	Irrigation schedule	December, 2011 to November, 2012					December, 2012 to November, 2013				
			3 months	6 months	9 months	12 months	Total	3 months	6 months	9 months	12 months	Total
T ₀	Control		0.30	0.40	3.50	2.40	6.60	0.50	0.68	2.20	0.80	4.18
T ₁	FYM	When required	0.90	1.37	8.13	9.43	19.83	1.44	1.53	12.17	11.73	26.88
T ₂	NC	When required	0.80	1.26	7.30	8.00	17.36	1.01	1.14	11.10	10.43	23.68
T ₃	VC	When required	1.10	1.67	8.87	10.17	21.80	1.71	1.67	13.57	12.50	29.44
T ₄	FYM	10 Days	0.90	1.37	8.03	9.17	19.47	1.28	1.40	11.83	11.37	25.88
T ₅	FYM	20 Days	0.90	1.27	7.80	8.37	18.33	1.10	1.37	11.47	11.10	25.03
T ₆	FYM	30 Days	0.50	0.43	5.80	7.28	14.01	1.00	0.70	7.73	8.57	18.00
T ₇	NC	10 Days	0.70	0.97	6.98	7.70	16.35	1.01	1.08	10.30	10.27	22.65
T ₈	NC	20 Days	0.70	0.53	6.50	7.43	15.17	1.01	0.83	9.83	10.13	21.81
T ₉	NC	30 Days	0.50	0.43	5.10	7.07	13.10	0.83	0.70	7.40	5.90	14.83
T ₁₀	VC	10 Days	1.10	1.90	9.14	10.93	23.07	1.87	1.83	15.27	13.87	32.83
T ₁₁	VC	20 Days	0.90	1.60	8.40	9.97	20.87	1.56	1.60	12.83	12.10	28.09
T ₁₂	VC	30 Days	0.67	0.45	6.32	7.30	14.73	1.00	0.70	8.50	9.27	19.47
		F- test	S	S	S	S		S	S	S	S	
		S. Ed. (\pm)	0.21	0.19	1.68	1.87		0.32	0.27	2.39	2.21	
		C. D. (P = 0.05)	0.43	0.40	3.47	3.86		0.66	0.56	4.93	4.57	

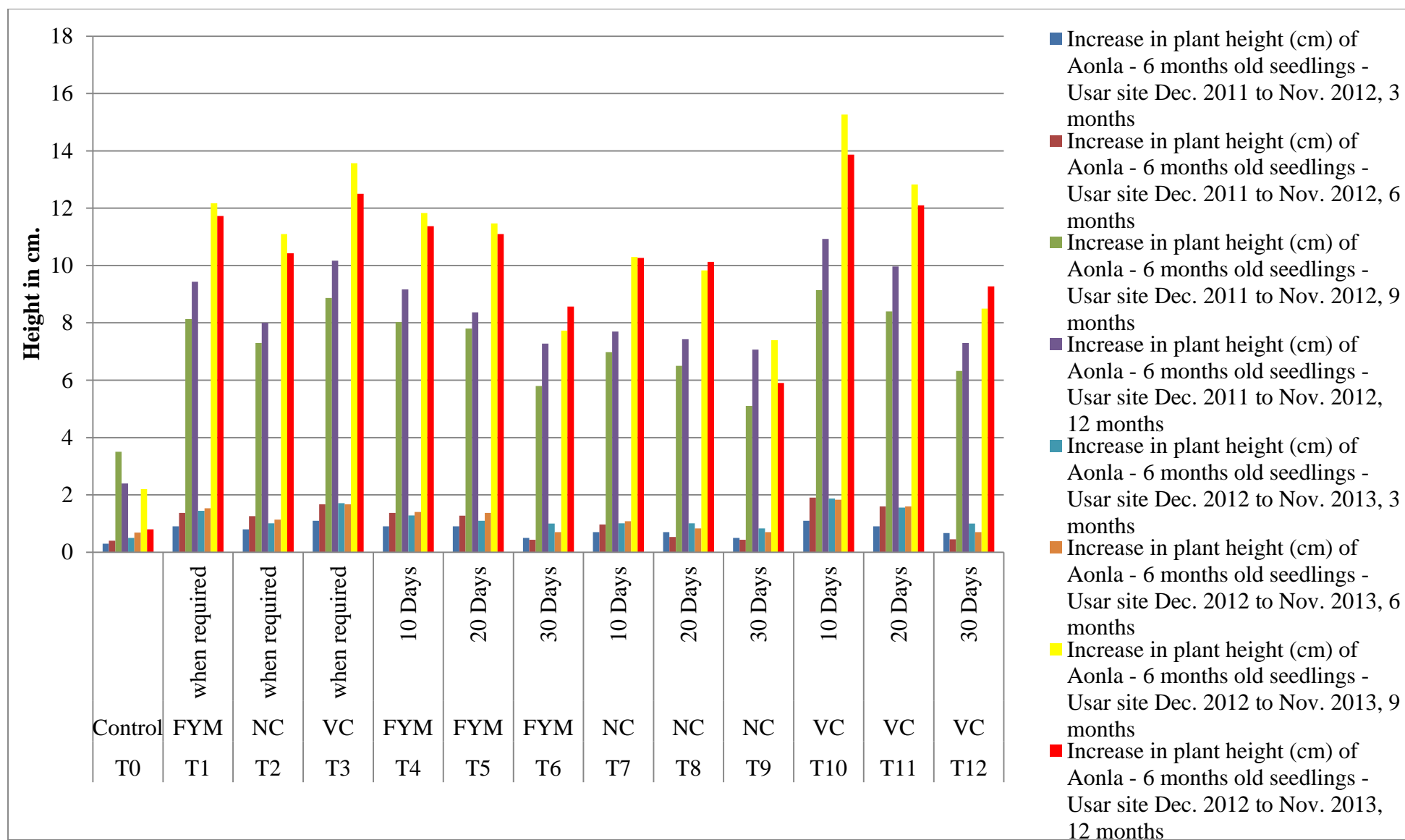


Fig. 4.16.1. Increase in plant height (cm) of six month old seedling of Aonla at Usar site in December, 2011 to November, 2013.

4.16.2. Increase in Collar diameter (cm) of six month old seedling of *Emblica officinalis* (Aonla) at Usar site in December, 2011 to November, 2012 and December, 2012 to November, 2013.

The Plant Collar diameter during first year (Table 4.16.2.) -

The results of the average Collar diameter after 3 month (0.27cm) was observed maximum in the treatment T₁₀ and followed by T₃ (0.23cm), T₁₁ (0.23cm) and T₄ (0.20cm), However, minimum increase Collar diameter was recorded in T₀ (0.10cm).

Collar diameter after 6 month (0.27cm) was observed maximum in T₁₀ and followed by T₃ (0.23cm), T₁₁ (0.20cm) and T₄ (0.20cm). However, minimum increase Collar diameter was recorded in T₀ (0.07cm).

Collar diameter after 9 month (1.03cm) was observed maximum in T₁₀ and followed by T₃ (1.00cm), T₁₁ (1.00cm) and T₄ (0.90cm). However, minimum increase Collar diameter was recorded in T₀ (0.44cm).

Collar diameter after 12 month (1.37cm) was observed maximum in T₁₀ and followed by T₃ (1.17cm), T₁₁ (1.00cm) and T₄ (1.00cm). However, minimum increase Collar diameter was recorded in T₀ (0.40cm). Other organic manure and irrigation schedule showed the significant difference in the plant Collar diameter in all monthly treatment of first year.

The Plant Collar diameter during second year (Table 4.16.2.) -

The results of the average Collar diameter after 3 month (0.53cm) was observed maximum in the treatment T₁₀ and followed by T₃ (0.47cm), T₁₁ (0.40cm) and T₄ (0.33cm). However, minimum increase Collar diameter was recorded in T₀ (0.15cm).

Collar diameter after 6 month (1.38cm) was observed maximum in T₁₀ and followed by T₃ (1.07cm), T₁₁ (1.07cm) and T₄ (0.80cm). However, minimum increase Collar diameter was recorded in T₀ (0.30cm).

Collar diameter after 9 month (1.34cm) was observed maximum in T₁₀ and followed by T₃ (1.30cm), T₁₁ (1.17cm) and T₄ (1.17cm). However, minimum increase Collar diameter was recorded in T₀ (0.15cm).

Collar diameter after 12 month (1.60cm) was observed maximum in T₁₀ and followed by T₃ (1.40cm), T₁₁ (1.20cm) and T₄ (1.10cm). However, minimum increase Collar diameter was recorded in T₀ (0.50cm). Other organic manure and irrigation schedule showed the significant difference in the plant Collar diameter in all monthly treatment of second year.

Table 4.16.2. Increase in collar diameter (cm) of six months old seedlings of Aonla (*Emblica officinalis*) at Usar site at different intervals (Year-wise)

Treatment No.	Treatment		Increase in collar diameter (cm) of Aonla - 6 months old seedlings - Usar site									
			December, 2011 to November, 2012					December, 2012 to November, 2013				
			3 months	6 months	9 months	12 months	Total	3 months	6 months	9 months	12 months	Total
T ₀	Control		0.10	0.07	0.44	0.40	1.01	0.15	0.30	0.15	0.50	1.10
T ₁	FYM	When required	0.20	0.20	0.93	1.00	2.33	0.37	0.90	1.17	1.20	3.63
T ₂	NC	When required	0.17	0.19	0.83	0.87	2.06	0.30	0.70	1.03	0.85	2.88
T ₃	VC	When required	0.23	0.23	1.00	1.17	2.63	0.47	1.07	1.30	1.40	4.23
T ₄	FYM	10 Days	0.20	0.20	0.90	1.00	2.30	0.33	0.80	1.17	1.10	3.40
T ₅	FYM	20 Days	0.20	0.20	0.87	0.97	2.23	0.30	0.73	0.93	0.93	2.90
T ₆	FYM	30 Days	0.10	0.13	0.70	0.62	1.55	0.24	0.56	0.64	0.60	2.04
T ₇	NC	10 Days	0.10	0.16	0.81	0.82	1.89	0.24	0.60	0.64	0.80	2.28
T ₈	NC	20 Days	0.10	0.13	0.74	0.76	1.73	0.24	0.57	0.86	0.80	2.47
T ₉	NC	30 Days	0.10	0.10	0.50	0.55	1.25	0.20	0.48	0.47	0.50	1.65
T ₁₀	VC	10 Days	0.27	0.27	1.03	1.37	2.93	0.53	1.38	1.34	1.60	4.86
T ₁₁	VC	20 Days	0.20	0.20	1.00	1.00	2.40	0.40	1.07	1.17	1.20	3.83
T ₁₂	VC	30 Days	0.10	0.13	0.70	0.70	1.63	0.24	0.57	0.70	0.60	2.11
		F- test	S	S	S	S		S	S	S	S	
		S. Ed. (\pm)	0.02	0.04	0.18	0.28		0.07	0.14	0.18	0.48	
		C. D. (P = 0.05)	0.04	0.08	0.38	0.58		0.14	0.29	0.36	0.99	

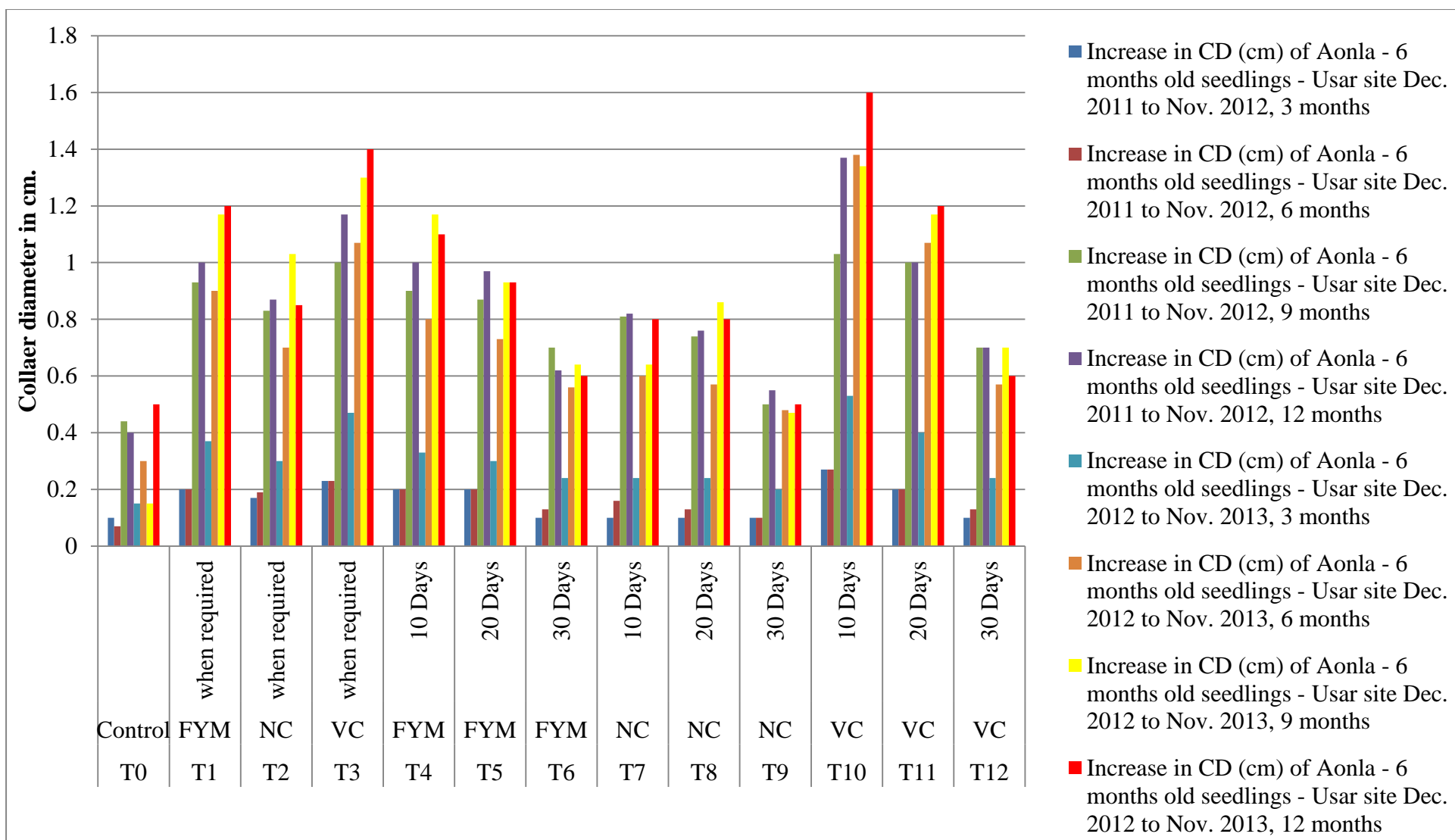


Fig. 4.16.2. Increase in Collar diameter (cm) of Aonla 6 month old seedling at Usar site in December, 2011 to November, 2013

4.16.3. Survival percentage of six month old seedling of *Embllica officinalis* (Aonla) at Usar Sites at different intervals in December, 2011 to November, 2012 and December, 2012 to November, 2013.

The Plant Survival percentage during first year (Table 4.16.3.) -

The survivability in first year of 3 month reported Aonla seedlings grown at Usar sites with different intervals of irrigation schedule along with the applications of organic manures available or provide in a form of different treatment combinations.

The study clearly indicates non significant maximum survival percentage i.e. 100% was found in T₁, T₂, T₃, T₄ T₅, T₇, T₈, T₁₀, T₁₁ and T₁₂ treatment. This followed T₀, T₆ and T₉, with 66.67% which shows minimum survival percentage of Aonla seedlings because of some deficiencies are found present in usar site with decrease physical properties of soil.

The result of 6 month Aonla indicates non significant maximum survival percentage i.e. 100% was found in T₁, T₃, T₄ T₅, T₁₀ and T₁₁ treatment. This followed T₀, T₂, T₆, T₇, T₈, T₉, T₁₂ with 66.67% which shows minimum survival percentage of Aonla seedlings.

The result of 9 month Aonla indicates non significant maximum survival percentage i.e. 100% was found in T₁, T₃, T₄ T₅, T₁₀ and T₁₁ Treatment. This followed T₂, T₆, T₇, T₈, T₉, T₁₂ with 66.67 % and T₀ (control) which shows minimum (33.33%) survival percentage of Aonla seedlings.

The result of 12 month Aonla indicates non significant maximum survival percentage i.e. 100% was found in T₁, T₃, T₄ T₅, T₁₀ and T₁₁ treatment. This followed T₂, T₆, T₇, T₈, T₁₂ with 66.67 % and T₀ (control) and T₉ which shows minimum (33.33%) survival percentage of Aonla seedlings.

The Plant Survival percentage during second year (Table 4.16.3.) -

The result of 3 month Aonla indicates non significant maximum survival percentage i.e. 100% was found in T₁, T₃, T₄ T₅, T₁₀ and T₁₁ treatment. This followed T₂, T₇ and T₈ with 66.67 % and T₀ (control), T₆, T₉ and T₁₂ which shows minimum (33.33%) survival percentage of Aonla seedlings.

The result of 6 month Aonla indicates non significant maximum survival percentage i.e. 100% was found in T₁, T₃, T₄ T₅, T₁₀ and T₁₁ due to good soil condition, nature of soil fertility availability essential minerals & nutrients, proper and good health condition of Aonla seedlings and its adaptability. This followed T₂ and T₇with 66.67 % and T₀ (control), T₆, T₈, T₉ and T₁₂ which shows minimum (33.33%) survival percentage of Aonla seedlings.

The result of 9 and 12 month Aonla indicates non significant maximum survival percentage i.e. 100% was found in T₁, T₃, T₄ T₅, T₁₀ and T₁₁ treatment. This followed T₂with 66.67% and T₀ (control), T₆, T₇, T₈, T₉ and T₁₂which shows minimum (33.33%) survival percentage of Aonla seedlings.

Table 4.16.3. Survival percentage of six months old seedlings of Aonla (*Emblica officinalis*) at Usar site at different intervals (Year-wise)

Treatment No.	Treatment		Survival percentage of Aonla - 6 months old seedlings - Usar site									
			December, 2011 to November, 2012					December, 2012 to November, 2013				
			3 months	6 months	9 months	12 months	Total	3 months	6 months	9 months	12 months	Total
T ₀	Control		66.67	66.67	33.33	33.33	33.33	33.33	33.33	33.33	33.33	33.33
T ₁	FYM	When required	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₂	NC	When required	100.00	66.67	66.67	66.67	66.67	66.67	66.67	66.67	66.67	66.67
T ₃	VC	When required	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₄	FYM	10 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₅	FYM	20 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₆	FYM	30 Days	66.67	66.67	66.67	66.67	66.67	33.33	33.33	33.33	33.33	33.33
T ₇	NC	10 Days	100.00	66.67	66.67	66.67	66.67	66.67	66.67	33.33	33.33	33.33
T ₈	NC	20 Days	100.00	66.67	66.67	66.67	66.67	66.67	33.33	33.33	33.33	33.33
T ₉	NC	30 Days	66.67	66.67	66.67	33.33	33.33	33.33	33.33	33.33	33.33	33.33
T ₁₀	VC	10 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₁₁	VC	20 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₁₂	VC	30 Days	100.00	66.67	66.67	66.67	66.67	33.33	33.33	33.33	33.33	33.33
		F- test	NS	NS	NS	NS		S	S	S	S	
		S. Ed. (±)	-	-	-	-		27.74	27.22	26.15	26.15	
		C. D. (P = 0.05)	-	-	-	-		57.25	56.17	53.97	53.97	

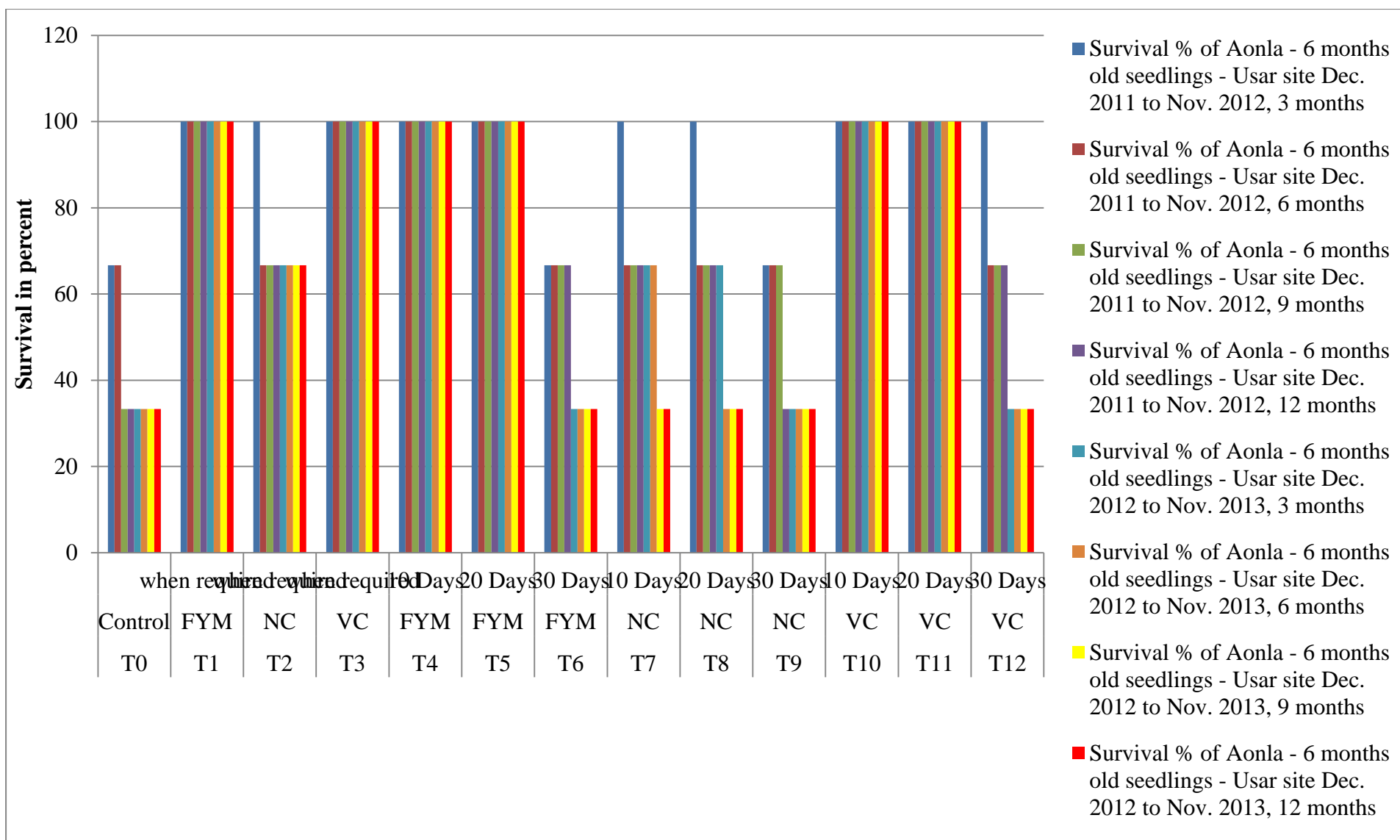


Fig. 4.16.3. Survival percentage of Aonla 6 month old seedling at Usar site in December, 2011 to November, 2013.

4.17. One year old seedling plantation of *Emblica officinalis* (Aonla) at Usar site:

4.17.1. Increase in plant height (cm) of one year old seedling of *Emblica officinalis* (Aonla) at Usar site in December, 2011 to November, 2012 and 2012 to November 2013.

The Plant height during first year (Table 4.17.1.) -

The results of the average plant height after 3 month (1.30cm) was observed maximum in the treatment T₁₀ and followed by T₃ (1.10cm), T₁₁ (1.00cm) and T₄ (0.80cm). However, minimum was recorded in T₀ (0.40cm).

Plant height after 6 month (2.73cm) was observed maximum in T₁₀ and followed by T₃ (2.40cm), T₁₁ (2.23cm) and T₄ (1.83cm). However, minimum was recorded in T₀ (1.00cm).

Plant height after 9 month (11.47cm) was observed maximum in T₁₀ and followed by T₃ (10.90cm), T₁₁ (10.80cm) and T₄ (10.10cm). However, minimum was recorded in T₀ (2.80cm).

Plant height after 12 month (20.97cm) was observed maximum in T₁₀ and followed by T₃ (19.13cm), T₁₁ (18.70cm) and T₄ (17.97cm). However, minimum was recorded in T₀ (2.65cm). Other organic manure and irrigation schedule showed the significant difference in the plant height in all monthly treatment of first year.

The Plant height during second year (Table 4.17.1.) -

The results of the average plant height after 3 month (1.94cm) was observed maximum in the treatment T₁₀ and followed by T₃ (2.12cm), T₁₁ (1.90cm) and T₄ (1.70cm). However, minimum was recorded in T₀ (0.70cm).

Plant height after 6 month (2.44cm) was observed maximum in T₁₀ and followed by T₃ (2.40cm), T₁₁ (2.17cm) and T₄ (1.97cm). However, minimum was recorded in T₀ (0.75cm).

Plant height after 9 month (16.80cm) was observed maximum in T₁₀ and followed by T₃ (16.13cm), T₁₁ (15.00cm) and T₄ (13.73cm). However, minimum was recorded in T₀ (2.50cm).

Plant height after 12 month (17.47cm) was observed maximum in T₁₀ and followed by T₃ (16.47cm), T₁₁ (16.27cm) and T₄ (15.07cm). However, minimum was recorded in T₀ (0.85cm). Other organic manure and irrigation schedule showed the significant difference in the plant height in all monthly treatment of second year.

Table 4.17.1. Increase in plant height (cm) of one year old seedlings of Aonla (*Emblica officinalis*) at Usar site at different intervals (Year-wise)

Treatment No.	Treatment		Increase in plant height (cm) of Aonla - one year old seedlings - Usar site									
	Organic manure	Irrigation schedule	December, 2011 to November, 2012					December, 2012 to November, 2013				
			3 months	6 months	9 months	12 months	Total	3 months	6 months	9 months	12 months	Total
T ₀	Control		0.40	1.00	2.80	2.65	6.85	0.70	0.75	2.50	0.85	4.80
T ₁	FYM	When required	0.90	2.10	10.53	18.37	31.90	1.87	2.03	14.47	15.67	34.03
T ₂	NC	When required	0.80	1.60	9.83	17.27	29.50	1.47	1.58	11.93	14.37	29.35
T ₃	VC	When required	1.10	2.40	10.90	19.13	33.53	2.12	2.40	16.13	16.47	37.12
T ₄	FYM	10 Days	0.80	1.83	10.10	17.97	30.70	1.70	1.97	13.73	15.07	32.47
T ₅	FYM	20 Days	0.80	1.73	10.00	17.60	30.13	1.56	1.70	13.18	15.02	31.46
T ₆	FYM	30 Days	0.60	1.20	6.33	11.63	19.77	1.07	1.08	9.53	10.27	21.95
T ₇	NC	10 Days	0.70	1.53	9.03	16.83	28.10	1.22	1.23	11.45	13.98	27.88
T ₈	NC	20 Days	0.70	1.43	8.47	16.37	26.97	1.15	1.22	10.95	13.07	26.38
T ₉	NC	30 Days	0.50	1.17	5.30	9.30	16.27	0.70	1.05	6.93	9.77	18.45
T ₁₀	VC	10 Days	1.30	2.73	11.47	20.97	36.47	1.94	2.44	16.80	17.47	38.66
T ₁₁	VC	20 Days	1.00	2.23	10.80	18.70	32.73	1.90	2.17	15.00	16.27	35.33
T ₁₂	VC	30 Days	0.70	1.23	7.16	12.50	21.59	1.15	1.18	10.73	10.60	23.67
		F- test	S	S	S	S		NS	S	S	S	
		S. Ed. (\pm)	0.19	0.24	1.23	4.13		-	0.55	3.69	3.99	
		C. D. (P = 0.05)	0.39	0.50	2.53	8.52		-	1.13	7.62	8.24	

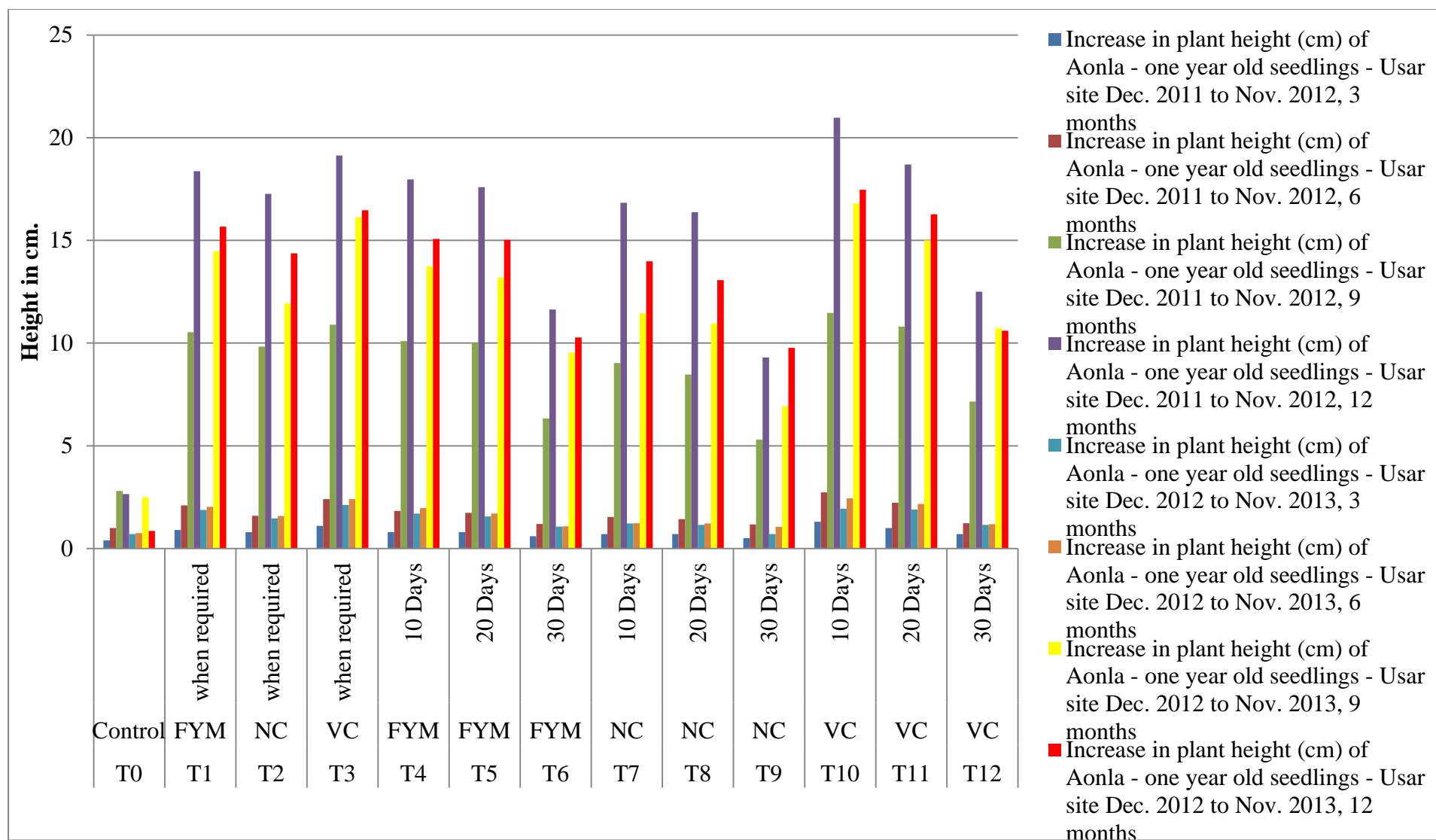


Fig. 4.17.1. Increase in plant height (cm) of one year old seedling of Aonla at Usar site in December, 2011 to November, 2013.

4.17.2. Increase in Collar diameter (cm) of one year old seedling of *Emblica officinalis* (Aonla) at Usar site in December, 2011 to November, 2012 and December, 2012 to November, 2013.

The Plant Collar diameter during first year (Table 4.17.2.) -

The results of the average Collar diameter after 3 month increase Collar diameter (0.63cm) was observed maximum in the treatment T₁₀ and followed by T₃ (0.33cm), T₁₁ (0.30cm) and T₄ (0.23cm), However, minimum increase Collar diameter was recorded in T₀ (0.10cm).

Collar diameter after 6 month increase Collar diameter (0.33cm) was observed maximum in T₁₀ and followed by T₃ (0.30cm), T₁₁ (0.23cm) and T₄ (0.20cm). However, minimum increase Collar diameter was recorded in T₀ (0.06cm).

Collar diameter after 9 month increase Collar diameter (1.27cm) was observed maximum in T₁₀ and followed by T₃ (1.23cm), T₁₁ (1.13cm) and T₄ (1.00cm). However, minimum increase Collar diameter was recorded in T₀ (0.60cm).

Collar diameter after 12 month increase Collar diameter (0.50cm) was observed maximum in T₁₀ and followed by T₃ (1.53cm), T₁₁ (1.47cm) and T₄ (1.43cm). However, minimum increase Collar diameter was recorded in T₀ (0.09cm). Other organic manure and irrigation schedule showed the significant difference in the plant Collar diameter in all monthly treatment of first year.

The Plant Collar diameter during second year (Table 4.17.2.) -

The results of the average Collar diameter after 3 month increase Collar diameter (0.50cm) was observed maximum in the treatment T₁₀ and followed by T₃ (0.47cm), T₁₁ (0.40cm) and T₄ (0.37cm). However, minimum increase Collar diameter was recorded in T₀ (0.09cm).

Collar diameter after 6 month increase Collar diameter (1.90cm) was observed maximum in T₁₀ and followed by T₃ (1.65cm), T₁₁ (1.63cm) and T₄ (1.32cm). However, minimum increase Collar diameter was recorded in T₀ (0.25cm).

Collar diameter after 9 month increase Collar diameter (1.57cm) was observed maximum in T₁₀ and followed by T₃ (1.57cm), T₁₁ (1.47cm) and T₄ (1.37cm). However, minimum increase Collar diameter was recorded in T₀ (0.81cm).

Collar diameter after 12 month increase Collar diameter (2.60cm) was observed maximum in T₁₀ and followed by T₃ (1.80cm), T₁₁ (1.70cm) and T₄ (1.50cm). However, minimum increase Collar diameter was recorded in T₀ (0.55cm). Other organic manure and irrigation schedule showed the significant difference in the plant Collar diameter in all monthly treatment of second year.

Table 4.17.2. Increase in collar diameter (cm) of one year old seedlings of Aonla (*Emblica officinalis*) at Usar site at different intervals (Year-wise)

Treatment No.	Treatment		Increase in collar diameter (cm) of Aonla - one year old seedlings - Usar site									
			December, 2011 to November, 2012					December, 2012 to November, 2013				
	Organic manure	Irrigation schedule	3 months	6 months	9 months	12 months	Total	3 months	6 months	9 months	12 months	Total
T ₀	Control		0.10	0.06	0.60	0.50	1.27	0.09	0.25	0.81	0.55	1.70
T ₁	FYM	When required	0.23	0.20	1.03	1.43	2.90	0.40	1.57	1.43	1.60	5.00
T ₂	NC	When required	0.20	0.20	0.93	1.37	2.70	0.33	0.93	1.13	1.50	3.89
T ₃	VC	When required	0.33	0.30	1.23	1.53	3.40	0.47	1.65	1.57	1.80	5.48
T ₄	FYM	10 Days	0.23	0.20	1.00	1.43	2.87	0.37	1.32	1.37	1.50	4.55
T ₅	FYM	20 Days	0.20	0.20	0.97	1.37	2.73	0.33	0.93	1.35	1.50	4.12
T ₆	FYM	30 Days	0.10	0.17	0.73	1.04	2.04	0.19	0.40	0.86	0.80	2.25
T ₇	NC	10 Days	0.20	0.17	0.90	1.35	2.61	0.30	0.77	1.03	1.32	3.42
T ₈	NC	20 Days	0.10	0.17	0.83	1.33	2.43	0.30	0.38	1.00	1.00	2.68
T ₉	NC	30 Days	0.10	0.11	0.67	0.97	1.85	0.19	0.34	0.83	0.69	2.05
T ₁₀	VC	10 Days	0.63	0.33	1.27	1.63	3.87	0.50	1.90	1.57	2.60	6.57
T ₁₁	VC	20 Days	0.30	0.23	1.13	1.47	3.13	0.40	1.63	1.47	1.70	5.20
T ₁₂	VC	30 Days	0.10	0.17	0.82	1.06	2.15	0.30	0.40	0.92	0.95	2.57
		F- test	S	S	S	S		S	S	S	S	
		S. Ed. (\pm)	0.02	0.02	0.16	0.39		0.08	0.27	0.36	0.55	
		C. D. (P = 0.05)	0.04	0.04	0.32	0.80		0.17	0.55	0.74	1.14	

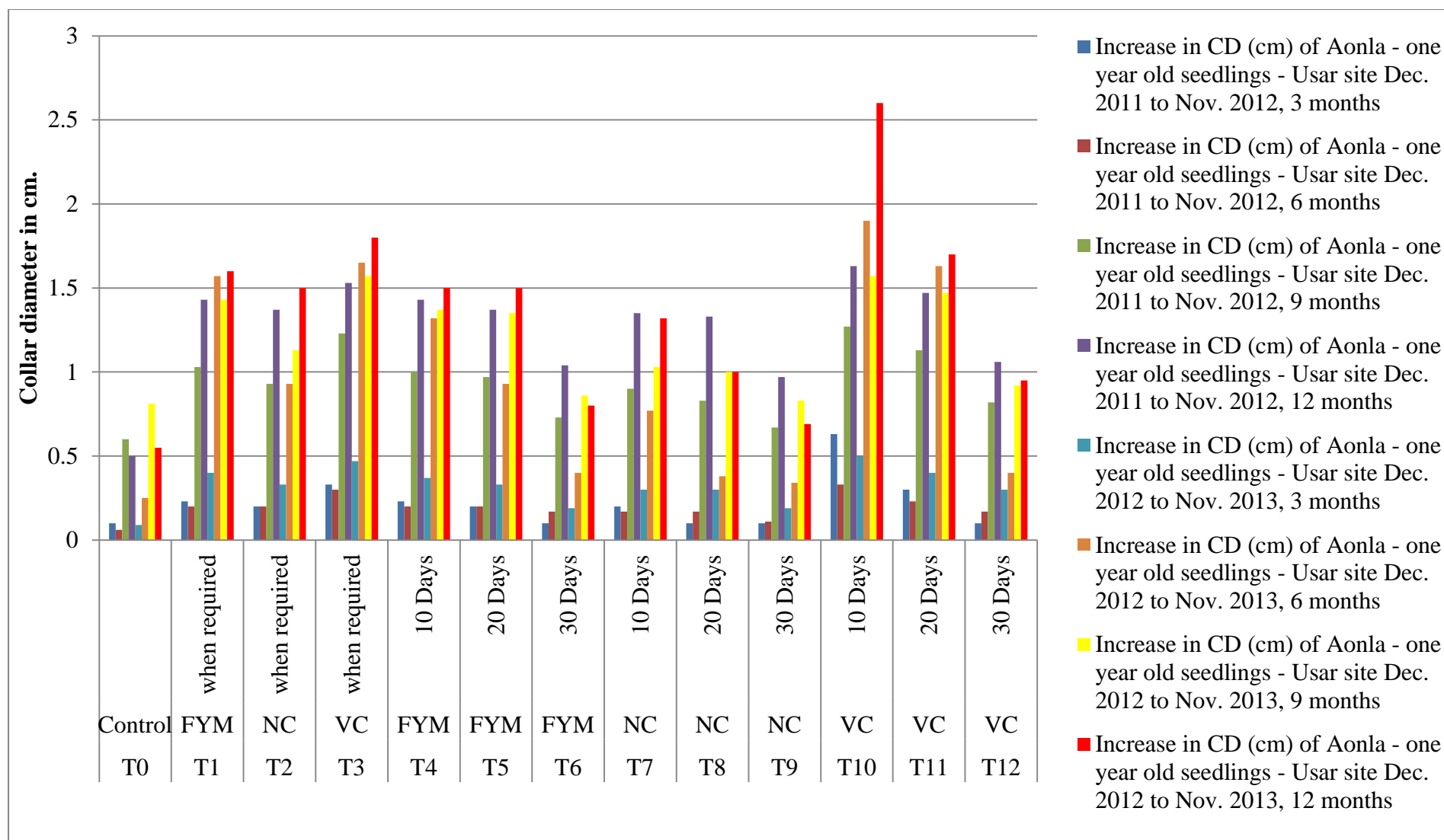


Fig. 4.17.2. Increase in Collar diameter (cm) of one year old seedling of Aonla at Usar site in December, 2011 to November, 2013.

4.17.3. Survival percentage of one year old seedling of *Emblica officinalis* (Aonla) at Usar Sites at different intervals in December, 2011 to November, 2012 and December, 2012 to November, 2013.

The Plant Survival percentage during first year (Table 4.17.3.) -

The result of 3 and 6 month indicates non significant maximum survival percentage i.e. 100% was found in T₁, T₂, T₃, T₄ T₅, T₆, T₇, T₈, T₁₀, T₁₁ and T₁₂ treatment followed T₀ and T₉ with 66.67%.

The result of 9 month indicates non significant maximum survival percentage i.e. 100% was found in T₁, T₂, T₃, T₄ T₅, T₇, T₈, T₁₀, T₁₁ and T₁₂ treatment and followed T₀, T₆, and T₉ with 66.67%.

The result of 12 month indicates non significant maximum survival percentage i.e. 100% was found in T₁, T₂, T₃, T₄ T₅, T₁₀ and T₁₁ treatment followed T₀, T₆, T₇, T₈, T₉ and T₁₂ with 66.67%.

The Plant Survival percentage during second year (Table 4.17.3.) -

The result of 3 month indicates non significant maximum survival percentage i.e. 100% was found in T₁, T₂, T₃, T₄ T₅, T₁₀ and T₁₁ due to good soil condition, nature of soil fertility availability essential minerals & nutrients, proper and good health condition of Aonla seedlings and its adaptability followed T₀, T₆, T₇, T₈, T₉ and T₁₂ with 66.67%.

The survivality in second year of 6, 9 and 12 month old Aonla seedlings indicates non significant maximum survival percentage i.e. 100% was found in T₁, T₃, T₄, T₁₀ and T₁₁ due to good soil condition, nature of soil fertility availability essential minerals & nutrients, proper and good health condition of Aonla seedlings and its adaptability followed T₀, T₂, T₅, T₆, T₇, T₈, T₉ and T₁₂ with 66.67%.

Table 4.17.3. Survival percentage of one year old seedlings of Aonla (*Emblca officinalis*) at Usar site at different intervals (Year-wise)

Treatment No.	Treatment		Survival percentage of Aonla - one year old seedlings - Usar site									
			December, 2011 to November, 2012					December, 2012 to November, 2013				
	Organic manure	Irrigation schedule	3 months	6 months	9 months	12 months	Total	3 months	6 months	9 months	12 months	Total
T ₀	Control		66.67	66.67	66.67	66.67	66.67	66.67	66.67	66.67	66.67	66.67
T ₁	FYM	When required	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₂	NC	When required	100.00	100.00	100.00	100.00	100.00	100.00	66.67	66.67	66.67	66.67
T ₃	VC	When required	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₄	FYM	10 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₅	FYM	20 Days	100.00	100.00	100.00	100.00	100.00	100.00	66.67	66.67	66.67	66.67
T ₆	FYM	30 Days	100.00	100.00	66.67	66.67	66.67	66.67	66.67	66.67	66.67	66.67
T ₇	NC	10 Days	100.00	100.00	100.00	66.67	66.67	66.67	66.67	66.67	66.67	66.67
T ₈	NC	20 Days	100.00	100.00	100.00	66.67	66.67	66.67	66.67	66.67	66.67	66.67
T ₉	NC	30 Days	66.67	66.67	66.67	66.67	66.67	66.67	66.67	66.67	66.67	66.67
T ₁₀	VC	10 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₁₁	VC	20 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₁₂	VC	30 Days	100.00	100.00	100.00	66.67	66.67	66.67	66.67	66.67	66.67	66.67
		F- test	NS	NS	NS	NS		NS	NS	NS	NS	
		S. Ed. (\pm)	-	-	-	-		-	-	-	-	
		C. D. (P = 0.05)	-	-	-	-		-	-	-	-	

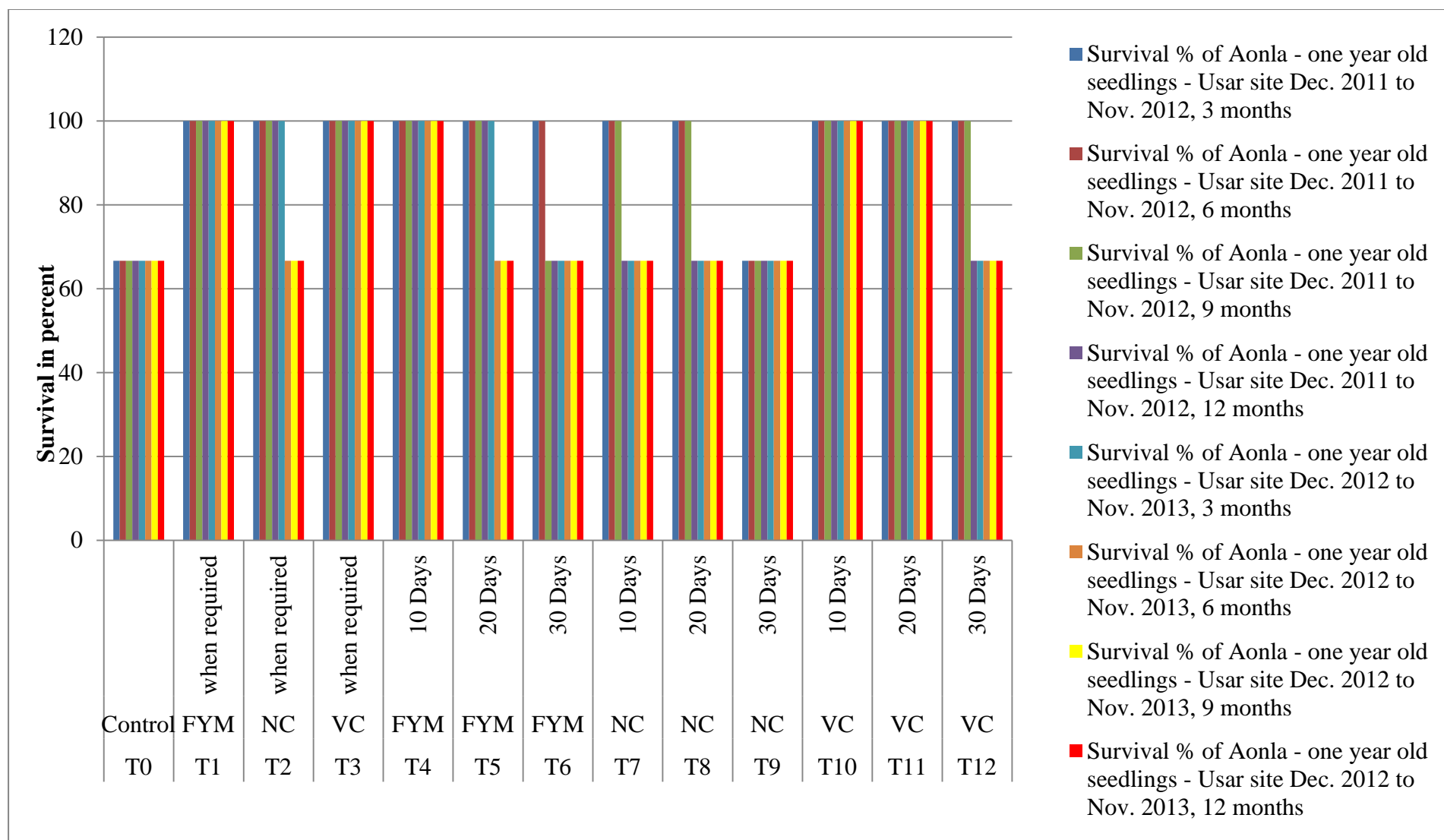


Fig. 4.17.3. Survival percentage of one year old seedling of Aonla at Usar site in December, 2011 to November, 2013.

4.18. Two year old seedling plantation of *Emblica officinalis* (Aonla) at Usar site:

4.18.1. Increase in plant height (cm) of two year old seedling of *Emblica officinalis* (Aonla) at Usar site in December, 2011 to November, 2012 and December, 2012 to November, 2013.

The Plant height during first year (Table 4.18.1.) -

The results of the average plant height after 3 month (1.50cm) was observed maximum in the treatment T₁₀ and followed by T₃(1.40cm), T₁₁(1.40cm) and T₄(1.30cm), However, minimum was recorded in T₀ (0.63cm).

Plant height after 6 month (4.27cm) was observed maximum in T₁₀ and followed by T₃ (4.13cm), T₁₁ (3.80cm) and T₄ (3.53cm). However, minimum was recorded in T₀ (0.45cm).

Plant height after 9 month (14.63cm) was observed maximum in T₁₀ and followed by T₃ (12.93cm), T₁₁ (12.70cm) and T₄ (11.83cm). However, minimum was recorded in T₀ (4.10cm).

Plant height after 12 month (22.27cm) was observed maximum in T₁₀ and followed by T₃ (20.90cm), T₁₁ (19.23cm) and T₄ (18.63cm). However, minimum was recorded in T₀ (2.40cm). Other organic manure and irrigation schedule showed the significant difference in the plant height in all monthly treatment of first year.

The Plant height during second year (Table 4.18.1.) -

Plant height after 3 month (2.77cm) was observed maximum in the treatment T₁₀ and followed by T₃ (1.96cm), T₁₁ (1.79cm) and T₄ (1.48cm). However, minimum was recorded in T₀ (0.70cm).

Plant height after 6 month (4.50cm) was observed maximum in T₁₀ and followed by T₃ (4.03cm), T₁₁ (3.73cm) and T₄ (2.82cm). However, minimum was recorded in T₀ (1.40cm).

Plant height after 9 month (18.90cm) was observed maximum in T₁₀ and followed by T₃ (17.57cm), T₁₁ (17.20cm) and T₄ (16.56cm). However, minimum was recorded in T₀ (4.10cm).

The results of the average plant height after 12 month (15.80cm) was observed maximum in T_{10} and followed by T_3 (14.87cm), T_{11} (14.40cm) and T_4 (13.17cm). However, minimum was recorded in T_0 (3.00cm). Other organic manure and irrigation schedule showed the significant difference in the plant height in all monthly treatment of second year.

Table 4.18.1. Increase in plant height (cm) of two years old seedlings of Aonla (*Emblica officinalis*) at Usar site at different intervals (Year-wise)

Treatment No.	Treatment		Increase in plant height (cm) of Aonla - two years old seedlings - Usar site									
	Organic manure	Irrigation schedule	December, 2011 to November, 2012					December, 2012 to November, 2013				
			3 months	6 months	9 months	12 months	Total	3 months	6 months	9 months	12 months	Total
T ₀	Control		0.63	0.45	4.10	2.40	7.58	0.70	1.40	4.10	3.00	9.20
T ₁	FYM	When required	1.40	3.67	12.50	19.00	36.57	1.63	3.30	16.97	14.00	35.90
T ₂	NC	When required	1.10	2.90	11.27	17.50	32.77	1.20	2.07	14.43	12.70	30.40
T ₃	VC	When required	1.40	4.13	12.93	20.90	39.37	1.96	4.03	17.57	14.87	38.43
T ₄	FYM	10 Days	1.30	3.53	11.83	18.63	35.30	1.48	2.82	16.56	13.17	34.03
T ₅	FYM	20 Days	1.30	3.03	11.30	18.37	34.00	1.24	2.30	16.23	13.03	32.81
T ₆	FYM	30 Days	0.90	1.43	8.03	13.03	23.40	0.43	1.48	10.37	9.80	22.08
T ₇	NC	10 Days	1.10	2.70	9.83	16.53	30.17	1.07	2.03	13.28	12.53	28.91
T ₈	NC	20 Days	1.00	1.90	9.37	15.77	28.03	0.99	1.86	11.38	12.20	26.42
T ₉	NC	30 Days	0.90	0.82	5.05	12.68	19.45	0.37	1.43	7.63	8.35	17.78
T ₁₀	VC	10 Days	1.50	4.27	14.63	22.27	42.67	2.77	4.50	18.90	15.80	41.97
T ₁₁	VC	20 Days	1.40	3.80	12.70	19.23	37.13	1.79	3.73	17.20	14.40	37.12
T ₁₂	VC	30 Days	0.90	1.53	8.67	14.30	25.40	0.97	1.72	11.38	10.67	24.73
		F- test	S	S	S	S		S	S	S	S	
		S. Ed. (\pm)	0.19	0.62	0.87	1.40		0.44	0.39	1.60	1.98	
		C. D. (P = 0.05)	0.38	1.27	1.80	2.90		0.92	0.81	3.30	4.08	

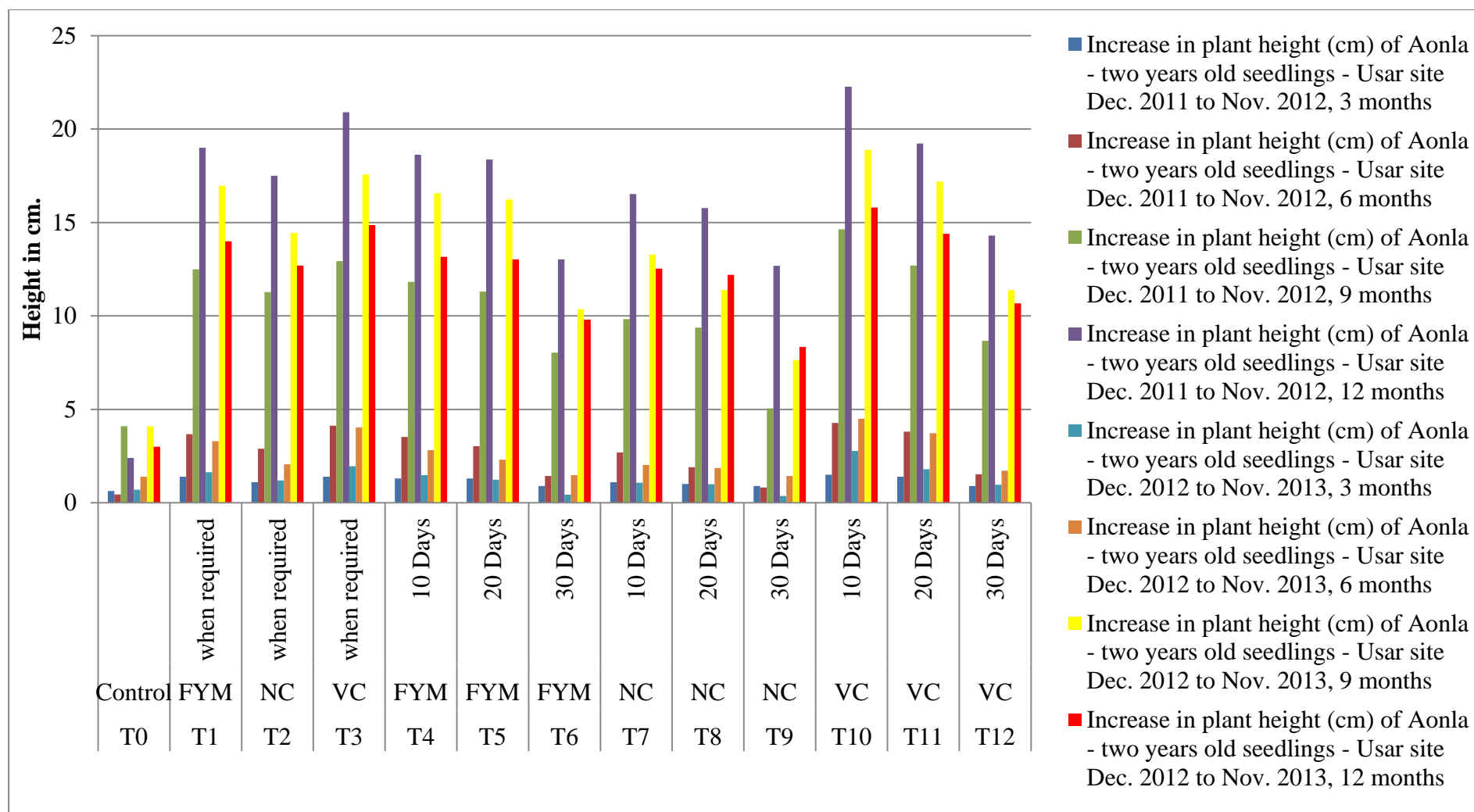


Fig. 4.18.1. Increase in plant height (cm) of two year old seedling of Aonla at Usar site in December, 2011 to November, 2013.

4.18.2. Increase in Collar diameter (cm) of two year old seedling of *Emblica officinalis* (Aonla) at Usar site in December, 2011 to November, 2012 and December, 2012 to November, 2013.

The Plant height during first year (Table 4.18.2.) -

The results of the average Collar diameter after 3 month (0.30cm) was observed maximum in the treatment T_{10} and followed by T_3 (0.30cm), T_{11} (0.30cm) and T_4 (0.20cm), However, minimum increase Collar diameter was recorded in T_0 (0.10cm).

Collar diameter after 6 month (0.30cm) was observed maximum in T_{10} and followed by T_3 (0.27cm), T_{11} (0.25cm) and T_4 (0.17cm). However, minimum increase Collar diameter was recorded in T_0 (0.09cm).

Collar diameter after 9 month (1.40cm) was observed maximum in T_{10} and followed by T_3 (1.33cm), T_{11} (1.30cm) and T_4 (1.30cm). However, minimum increase Collar diameter was recorded in T_0 (0.78cm).

Collar diameter after 12 month (1.87cm) was observed maximum in T_{10} and followed by T_3 (1.70cm), T_{11} (1.67cm) and T_4 (1.47cm). However, minimum increase Collar diameter (0.66cm) was recorded in T_0 (0.66cm). Other organic manure and irrigation schedule showed the significant difference in the plant Collar diameter in all monthly treatment of first year.

The Plant height during second year (Table 4.18.1.) -

The results of the average Collar diameter after 3 month (0.50cm) was observed maximum in the treatment T_{10} and followed by T_3 (0.50cm), T_{11} (0.47cm) and T_4 (0.37cm). However, minimum increase Collar diameter was recorded in T_0 (0.19cm).

Collar diameter after 6 month (1.70cm) was observed maximum in T_{10} and followed by T_3 (1.60cm), T_{11} (1.60cm) and T_4 (1.20cm). However, minimum increase Collar diameter was recorded in T_0 (0.19cm).

Collar diameter after 9 month (1.67cm) was observed maximum in T_{10} and followed by T_3 (1.60cm), T_{11} (1.60cm) and T_4 (1.37cm). However, minimum increase Collar diameter was recorded in T_0 (0.36cm).

Collar diameter after 12 month (2.40cm) was observed maximum in T₁₀ and followed by T₃ (2.10cm), T₁₁ (2.00cm) and T₄ (1.80cm). However, minimum increase Collar diameter was recorded in T₀ (0.20cm). Other organic manure and irrigation schedule showed the significant difference in the plant Collar diameter in all monthly treatment of second year.

Table4.18.2. Increase in collar diameter (cm) of two years old seedlings of Aonla (*Emblca officinalis*) at Usar site at different intervals (Year-wise)

Treatment No.	Treatment		Increase in collar diameter (cm) of Aonla - two years old seedlings - Usar site									
			December, 2011 to November, 2012					December, 2012 to November, 2013				
			3 months	6 months	9 months	12 months	Total	3 months	6 months	9 months	12 months	Total
T ₀	Control		0.10	0.09	0.78	0.66	1.62	0.19	0.19	0.36	0.20	0.94
T ₁	FYM	When required	0.20	0.17	1.30	1.67	3.33	0.40	1.35	1.53	2.00	5.28
T ₂	NC	When required	0.20	0.14	1.23	1.43	3.00	0.33	0.83	1.20	1.80	4.17
T ₃	VC	When required	0.30	0.27	1.33	1.70	3.60	0.50	1.60	1.60	2.10	5.80
T ₄	FYM	10 Days	0.20	0.17	1.30	1.47	3.14	0.37	1.20	1.37	1.80	4.73
T ₅	FYM	20 Days	0.20	0.14	1.30	1.45	3.09	0.33	1.05	1.27	1.80	4.45
T ₆	FYM	30 Days	0.10	0.10	0.83	0.93	1.97	0.20	0.40	0.82	1.19	2.61
T ₇	NC	10 Days	0.10	0.14	1.20	1.13	2.57	0.33	0.80	1.13	1.60	3.87
T ₈	NC	20 Days	0.10	0.13	1.03	1.13	2.39	0.23	0.73	0.90	1.20	3.07
T ₉	NC	30 Days	0.10	0.10	0.78	0.88	1.86	0.20	0.21	0.82	0.80	2.03
T ₁₀	VC	10 Days	0.30	0.30	1.40	1.87	3.87	0.50	1.70	1.67	2.40	6.27
T ₁₁	VC	20 Days	0.30	0.25	1.30	1.67	3.52	0.47	1.60	1.60	2.00	5.67
T ₁₂	VC	30 Days	0.10	0.10	0.90	1.13	2.23	0.23	0.67	0.89	1.20	2.99
		F- test	S	S	S	S		S	S	S	S	
		S. Ed. (\pm)	0.01	0.02	0.15	0.15		0.04	0.08	0.16	0.35	
		C. D. (P = 0.05)	0.02	0.05	0.32	0.31		0.07	0.17	0.33	0.73	

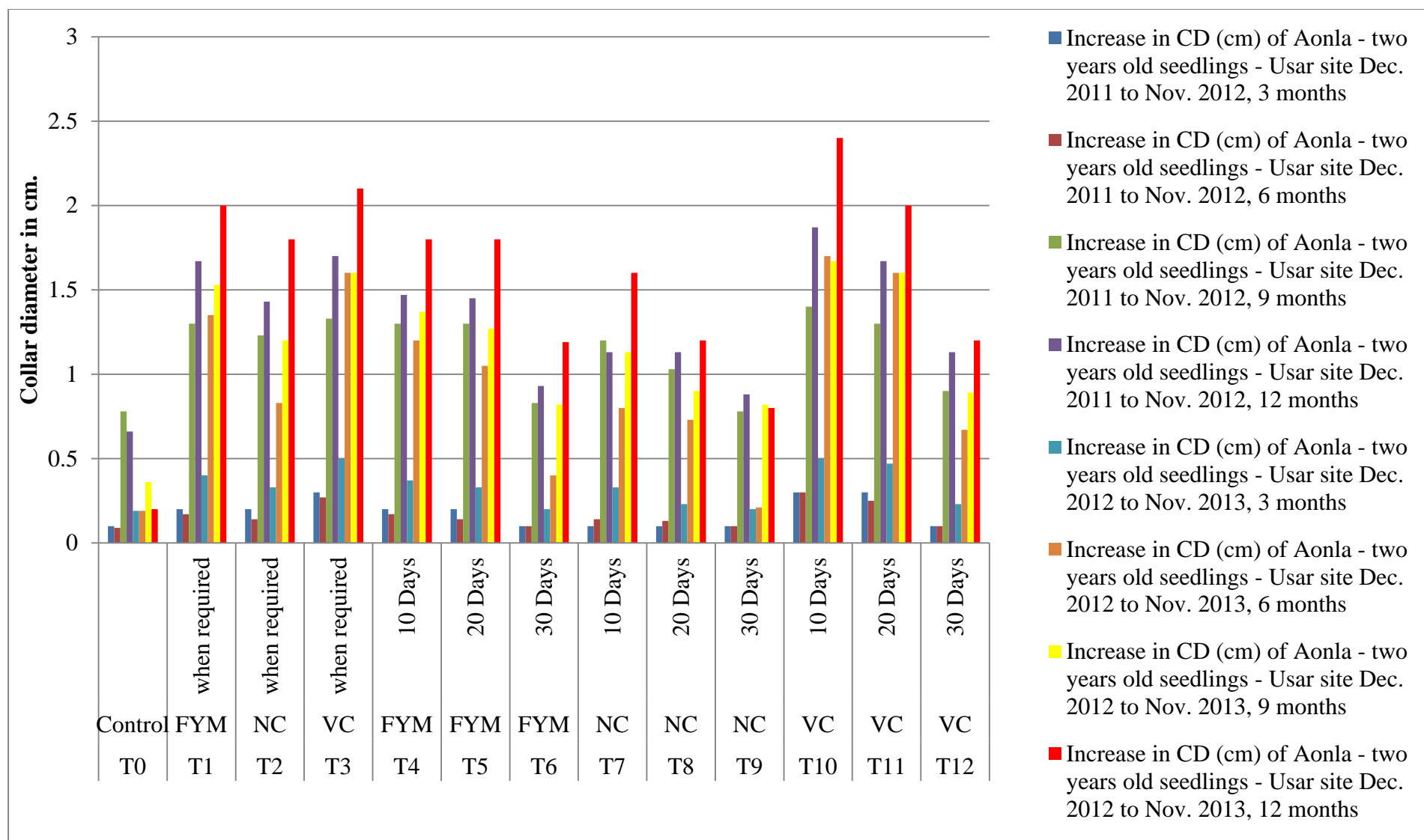


Fig. 4.18.2. Increase in Collar diameter (cm) of Two year old seedling of Aonla at Usar site in December, 2011 to November, 2013.

4.18.3. Survival percentage of two year old seedling of *Emblica officinalis* (Aonla) at Usar Sites at different intervals in December 2011 to November 2013.

The Plant Survival percentage during first year (Table 4.18.3.) -

The result of 3 month indicates non significant maximum survival percentage i.e. 100% was found in T₁, T₂, T₃, T₄ T₅, T₆, T₇, T₈, T₁₀, T₁₁ and T₁₂ due to good soil condition, nature of soil fertility availability essential minerals & nutrients, proper and good health condition of Aonla seedlings and its adaptability.

The survivality in first year of 6 and 9 month reported Aonla seedlings grown at usar sites with different intervals of irrigation schedule along with the applications of organic manures available or provide in a form of different treatment combinations.

The survivality in first year of 6 and 9 month reported Aonla seedlings indicates non significant maximum survival percentage i.e. 100% was found in T₁, T₂, T₃, T₄ T₅, T₆, T₇, T₈, T₁₀, T₁₁ and T₁₂ treatment followed with T₉ 66.67% and the minimum survival percentage (66.67) was found in T₀.

The survivality in first year of 12 month and second year of 3 month reported Aonla seedlings indicates significant maximum survival percentage i.e. 100% was found in T₁, T₂, T₃, T₄ T₅, T₆, T₇, T₈, T₁₀, T₁₁ and T₁₂ due to good soil condition, nature of soil fertility availability essential minerals & nutrients, proper and good health condition of Aonla seedlings and its adaptability followed with T₉ 66.67% and the minimum survival percentage (33.33) was found in T₀.

The Plant Survival percentage during second year (Table 4.18.3.) -

The survivality in second year of 3, 6, 9 month reported Aonla seedlings indicates significant maximum survival percentage i.e. 100% was found in T₁, T₂, T₃, T₄ T₅, T₇, T₈, T₁₀, T₁₁ and T₁₂ due to good soil condition, nature of soil fertility availability essential minerals & nutrients, proper and good health condition of Aonla seedlings and its adaptability followed with T₆, T₉ 66.67% and the minimum survival percentage (33.33) was found in T₀. Overall it is observed that treatment T₁₀ (vermicompost @ 10 days of irrigation schedule) with maximum survivality or survival % i.e. 100@ along with other attributes or observatory parameters would consider the best treatment combination.

Table 4.18.3. Survival percentage of two years old seedlings of Aonla (*Emblica officinalis*) at Usar site at different intervals (Year-wise)

Treatment No.	Treatment		Survival percentage of Aonla - two years old seedlings - Usar site									
			December, 2011 to November, 2012					December, 2012 to November, 2013				
			3 months	6 months	9 months	12 months	Total	3 months	6 months	9 months	12 months	Total
T ₀	Control		100.00	66.67	66.67	33.33	33.33	33.33	33.33	33.33	33.33	33.33
T ₁	FYM	When required	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₂	NC	When required	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₃	VC	When required	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₄	FYM	10 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₅	FYM	20 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₆	FYM	30 Days	100.00	100.00	100.00	100.00	100.00	100.00	66.67	66.67	66.67	66.67
T ₇	NC	10 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₈	NC	20 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₉	NC	30 Days	100.00	66.67	66.67	66.67	66.67	66.67	66.67	66.67	66.67	66.67
T ₁₀	VC	10 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₁₁	VC	20 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
T ₁₂	VC	30 Days	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
		F- test	NS	NS	NS	S		S	NS	NS	NS	
		S. Ed. (\pm)		-	-	18.10		18.10	-	-	-	
		C. D. (P = 0.05)		-	-	37.36		37.36	-	-	-	

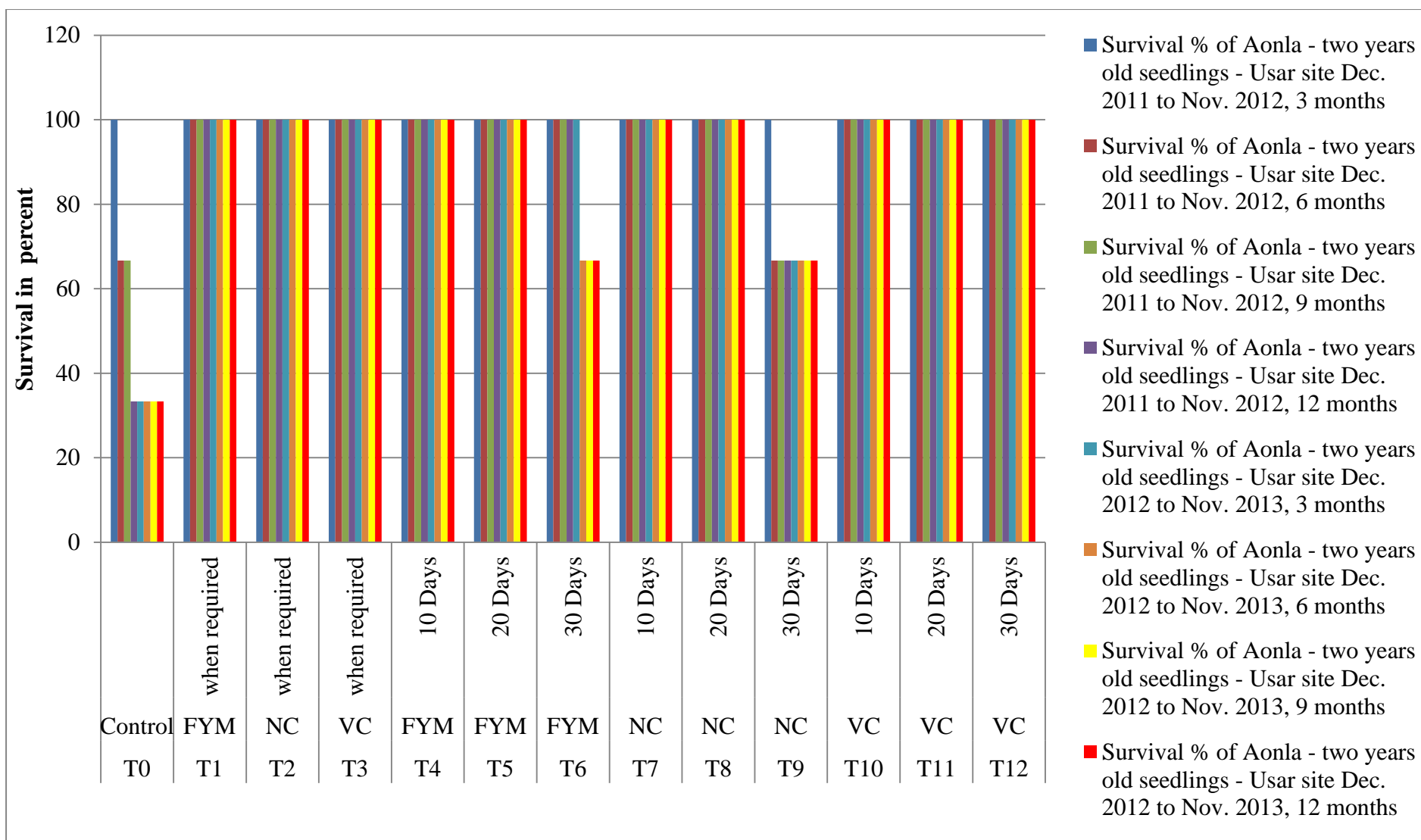


Fig. 4.18.3. Survival percentage of two year old seedling of Aonla at Usar site in December, 2011 to November, 2013.

4.19. Comparative results of *Carissa carandas* (Karondha) plantation at Rocky and Usar:

4.19.1. Increase in plant height (cm) of *Carissa carandas* (Karondha) at Rocky and Usar sites during two years (December 2011 to November 2013).

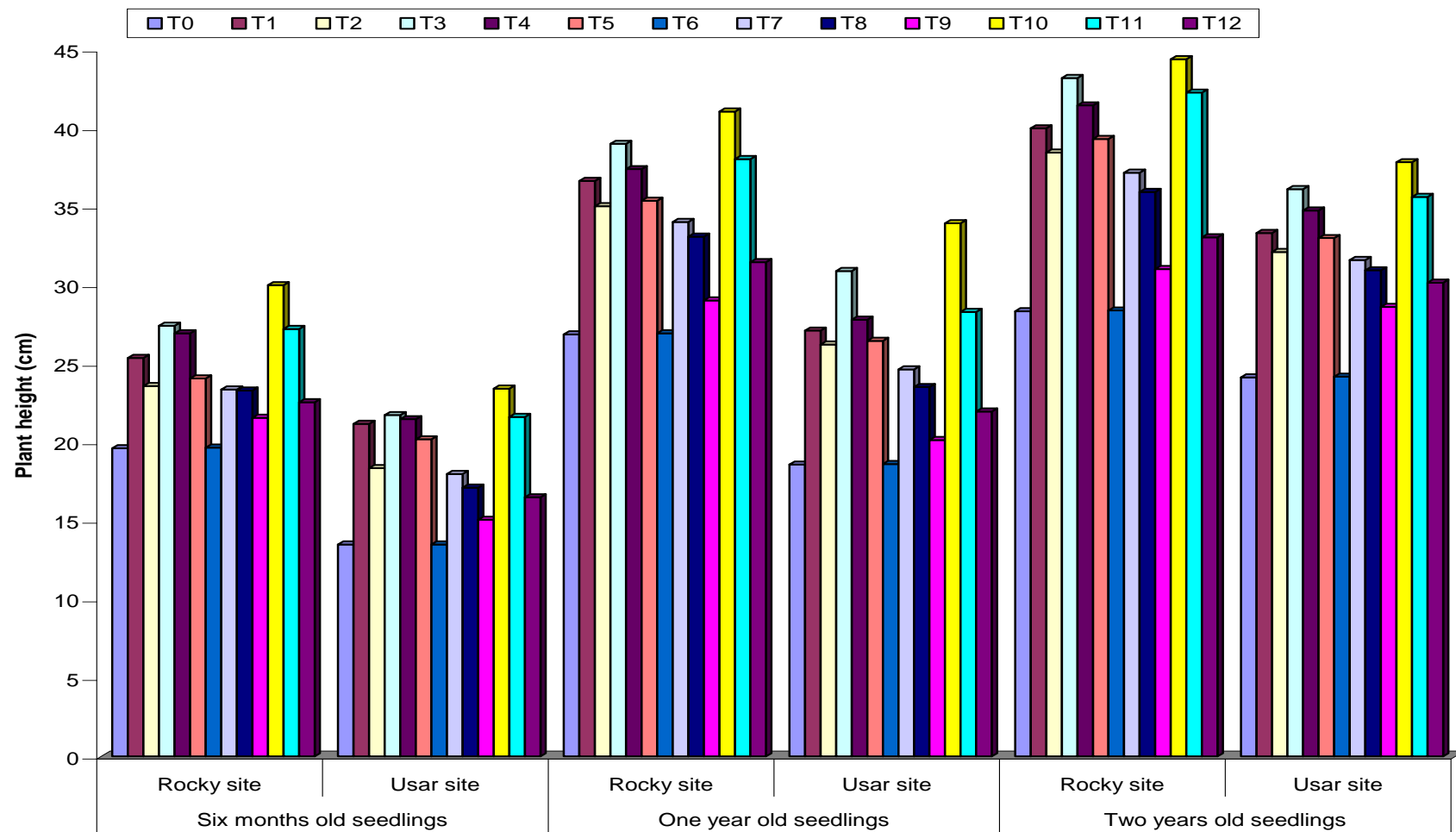
The data in respect of six month old seedling increase in plant height was presented in Table 4.19.1. and fig. 4.19.1. it was clear from the table that there was significant different among plant height. The maximum were found in T₁₀ (30.00cm) (Vermicompost) with 10 days irrigation schedule and followed by T₁₁ (27.21cm), T₄ (26.94cm) and T₇ (23.36cm) and minimum were found in treatment T₀ (19.62cm) at Rocky sites. While as the maximum (23.42cm) were found in T₁₀ (Vermicompost) with 10 days irrigation schedule and followed by T₃ (21.73cm), T₁₁ (21.61cm) and T₄ (21.47cm) and minimum were found in treatment T₀ (13.49cm) at Usar sites.

The data in respect of one year old seedling plant height are presented in Table 4.19.1. and fig. 4.19.1. it is clear from the table that there was significant different among plant height. The maximum were found in T₁₀ (41.06cm) (Vermicompost) with 10 days irrigation schedule and followed by T₃ (39.00cm), T₁₁ (38.03cm) and T₄ (37.39cm) and minimum were found in treatment T₀ (26.87cm) at Rocky sites. While as the maximum (33.94cm) were found in T₁₀ (Vermicompost) with 10 days irrigation schedule and followed by T₃ (30.90cm), T₁₁ (28.30cm) and T₄ (27.81cm) and minimum were found in treatment T₀ (18.58cm) at Usar sites.

The data in respect of two year old seedling plant height are presented in Table 4.19.1. and fig. 4.19.1. it is clear from the table that there was significant different among plant height. The maximum (44.39) were found in T₁₀ (Vermicompost) with 10 days irrigation schedule and followed by T₁₁ (42.26cm), T₃ (36.12cm) and T₄ (34.75cm) and minimum (28.84cm) were found in treatment T₀ (control) at Rocky sites. While The maximum (37.83cm) were found in T₁₀ (Vermicompost) with 10 days irrigation schedule and followed by T₃ (36.12cm), T₁₁ (35.62cm) and T₄ (34.75cm) and minimum were found in treatment T₀ (24.13cm) at Usar sites.

Table 4.19.1. Increase in plant height (cm) of Kaondha (*Carissa carandas*) at Rocky and Usar sites during two years (December, 2011 to November, 2013)

Treatment No.	Treatment		Increase in plant height (cm) of Karondha					
	Organic manure	Irrigation schedule	Six months old seedlings		One year old seedlings		Two years old seedlings	
			Rocky site	Usar site	Rocky site	Usar site	Rocky site	Usar site
T ₀	Control		19.62	13.49	26.87	18.58	28.34	24.13
T ₁	FYM		25.37	21.17	36.64	27.11	39.99	33.32
T ₂	NC		23.58	18.35	35.03	26.22	38.44	32.11
T ₃	VC		27.42	21.73	39.00	30.90	43.19	36.12
T ₄	FYM	10 Days	26.94	21.47	37.39	27.81	41.45	34.75
T ₅	FYM	20 Days	24.06	20.19	35.37	26.46	39.31	33.00
T ₆	FYM	30 Days	19.66	13.49	26.94	18.61	28.39	24.18
T ₇	NC	10 Days	23.36	17.98	34.02	24.64	37.16	31.60
T ₈	NC	20 Days	23.29	17.11	33.09	23.52	35.94	30.95
T ₉	NC	30 Days	21.56	15.07	29.03	20.14	31.02	28.62
T ₁₀	VC	10 Days	30.00	23.42	41.06	33.94	44.39	37.83
T ₁₁	VC	20 Days	27.21	21.61	38.03	28.30	42.26	35.62
T ₁₂	VC	30 Days	22.55	16.50	31.47	21.96	33.05	30.16
		F- test	S	S	S	S	S	S
		S. Ed. (\pm)	3.85	3.42	3.97	4.05	5.23	5.94
		C. D. (P = 0.05)	7.95	7.05	8.19	8.36	10.79	12.26



4.19.1. Increase in plant height (cm) of Karondha at Rocky and Usar sites during two years (December, 2011 to November, 2013).

4.19.2. Increase in collar diameter (cm) of *Carissa carandas* (Karondha) at Rocky and Usar sites during two years (December 2011 to November 2013)

The data in respect of six month old seedling collar diameter are presented in Table 4.19.2. and fig. 4.19.2. it is clear from the table that there was significant different among plant height. The maximum increase collar diameter (3.89cm) were found in T₁₀ (Vermicompost) with 10 days irrigation schedule and followed by T₃(2.60cm), T₁₁(2.44cm) and T₄(2.27cm) and minimum increase collar diameter were found in treatment T₀ (1.54cm) at Rocky sites. While The maximum increase collar diameter (2.43cm) were found in T₁₀ (Vermicompost) with 10 days irrigation schedule and followed by T₃ (2.29cm), T₁₁ (2.23cm) and T₄ (2.19cm) and minimum increase collar diameter were found in treatment T₀ (1.24cm) at Usar sites. While as other organic manure and irrigation schedule showed the significant differences in the plant collar diameter.

The data in respect of one year old seedling collar diameter are presented in Table 4.19.2. and fig. 4.19.2. it is clear from the table that there was significant different among plant height. The maximum increase collar diameter (3.58cm) were found in T₁₀ (Vermicompost) with 10 days irrigation schedule and followed by T₃ (3.52cm), T₁₁ (3.40cm) and T₄ (3.32cm) and minimum increase collar diameter were found in treatment T₀ (1.86cm) at Rocky sites. While the maximum increase collar diameter (3.31cm) were found in T₁₀ (Vermicompost) with 10 days irrigation schedule and followed by T₃ (3.25cm), T₁₁ (3.22cm) and T₄ (3.12cm) and minimum increase collar diameter (1.33cm) were found in treatment T₀ (control) at Usar sites. While as other organic manure and irrigation schedule showed the significant differences in the plant collar diameter.

The data in respect of two year old seedling collar diameter are presented in Table 4.19.2. and fig. 4.19.2. it is clear from the table that there was significant different among plant height. The maximum increase collar diameter (4.43cm) were found in T₁₀ (Vermicompost) with 10 days irrigation schedule and followed by T₃ (4.29cm), T₁₁ (4.23cm) and T₄ (4.05cm) and minimum increase collar diameter were found in treatment T₀ (2.58cm) at Rocky sites. While the maximum increase collar diameter (4.14cm) were found in T₁₀ (Vermicompost) with 10 days irrigation schedule and

followed by T_3 (3.91cm), T_{11} (3.73cm) and T_4 (3.45cm) and minimum increase collar diameter were found in treatment T_0 (2.22cm) at Usar sites.

Table 4.19.2. Increase in collar diameter (cm) of Karondha (*Carissa carandas*) at Rocky and Usar sites during two years (December, 2011 to November, 2013)

Treatment No.	Treatment		Increase in collar diameter (cm) of Karondha					
	Organic manure	Irrigation schedule	Six months old seedlings		One year old seedlings		Two years old seedlings	
			Rocky site	Usar site	Rocky site	Usar site	Rocky site	Usar site
T ₀	Control		1.54	1.24	1.86	1.33	2.58	2.22
T ₁	FYM	When required	2.20	2.17	3.20	2.96	3.93	3.33
T ₂	NC	When required	2.14	1.98	2.89	2.69	3.61	3.05
T ₃	VC	When required	2.60	2.29	3.52	3.25	4.29	3.91
T ₄	FYM	10 Days	2.27	2.19	3.32	3.12	4.05	3.45
T ₅	FYM	20 Days	2.15	2.05	3.04	2.81	3.80	3.17
T ₆	FYM	30 Days	1.57	1.34	2.01	1.36	2.71	2.24
T ₇	NC	10 Days	2.02	1.82	2.63	2.50	3.56	2.88
T ₈	NC	20 Days	1.90	1.69	2.51	2.23	3.40	2.73
T ₉	NC	30 Days	1.73	1.35	2.06	1.70	2.71	2.45
T ₁₀	VC	10 Days	3.89	2.43	3.58	3.31	4.43	4.14
T ₁₁	VC	20 Days	2.44	2.23	3.40	3.22	4.23	3.73
T ₁₂	VC	30 Days	1.76	1.45	2.13	2.04	2.95	2.51
		F- test	S	S	S	S	S	S
		S. Ed. (\pm)	0.24	0.24	0.21	0.24	0.35	0.43
		C. D. (P = 0.05)	0.50	0.49	0.44	0.49	0.73	0.88

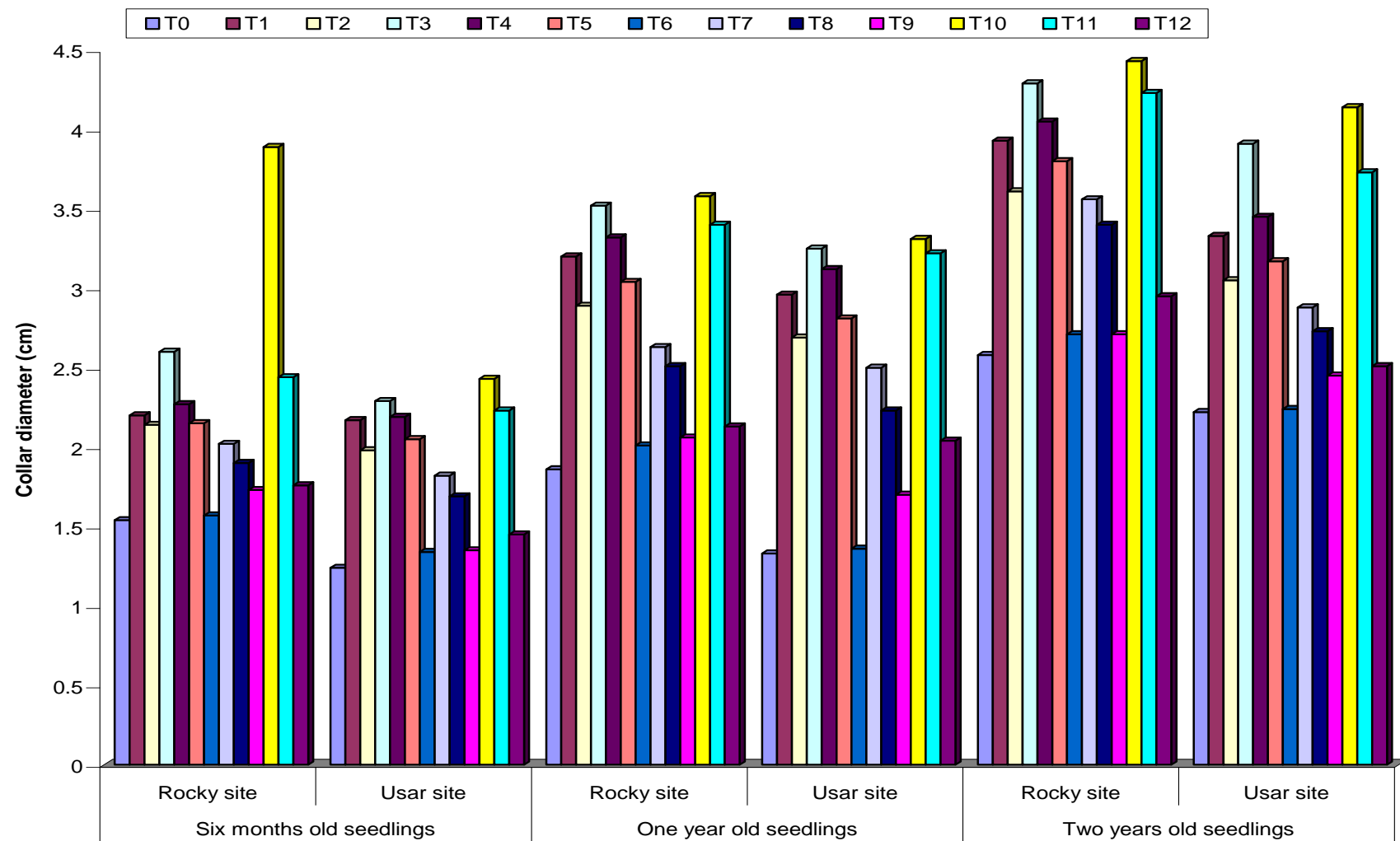


Fig. 4.19.2 Increase in collar diameter (cm) of Karondha at Rocky and Usar sites during two years (December, 2011 to November, 2013.)

4.19.3. Survival percentage of *Carissa carandas* (Karondha) plantation at Rocky and Usar sites during two years (December, 2011 to November, 2013)

The survivability of six month, one year and two year old Karondha seedlings grown at rocky and usar sites with different intervals of irrigation schedule along with the applications of organic manures available or provide in a form of different treatment combinations.

The study clearly indicates non significant maximum survival percentage i.e. 100% was found in T₁, T₂, T₃, T₄ T₅, T₇, T₈, T₁₀, T₁₁, T₁₂ and only T₉ in all age group at rocky due to good soil condition, nature of soil fertility availability essential minerals & nutrients, proper and good health condition of karondha seedlings and its adaptability. This followed T₆ and T₉ with 66.67 percent except T₉ in all age group at rocky and treatment T₀ (control) except T₉ (66.67) in one year old age group at rocky which shows (33.33%) minimum survival percentage of karondha seedlings because of some deficiencies are found present in usar site or decrease in physical nature of soil. Overall it is observed that treatment T₁₀ (Vermicompost) with 10 days of irrigation schedule) with maximum survivability or survival percentage i.e. 100% along with other attributes or observatory parameters would consider the best treatment combination.

Table 4.19.3. Survival percentage of Karondha (*Carissa carandas*) at Rocky and Usar sites during two years (December 2011, to November, 2013)

Treatment No.	Treatment		Survival percentage of Karondha					
	Organic manure	Irrigation schedule	Six months old seedlings		One year old seedlings		Two years old seedlings	
			Rocky site	Usar site	Rocky site	Usar site	Rocky site	Usar site
T ₀	Control		33.33	33.33	66.67	33.33	33.33	33.33
T ₁	FYM	When required	100.00	100.00	100.00	100.00	100.00	100.00
T ₂	NC	When required	100.00	100.00	100.00	100.00	100.00	100.00
T ₃	VC	When required	100.00	100.00	100.00	100.00	100.00	100.00
T ₄	FYM	10 Days	100.00	100.00	100.00	100.00	100.00	100.00
T ₅	FYM	20 Days	100.00	100.00	100.00	100.00	100.00	100.00
T ₆	FYM	30 Days	66.67	66.67	100.00	66.67	66.67	66.67
T ₇	NC	10 Days	100.00	100.00	100.00	100.00	100.00	100.00
T ₈	NC	20 Days	100.00	100.00	100.00	100.00	100.00	100.00
T ₉	NC	30 Days	100.00	66.67	100.00	66.67	100.00	66.67
T ₁₀	VC	10 Days	100.00	100.00	100.00	100.00	100.00	100.00
T ₁₁	VC	20 Days	100.00	100.00	100.00	100.00	100.00	100.00
T ₁₂	VC	30 Days	100.00	100.00	100.00	100.00	100.00	100.00
		F- test	S	NS	NS	NS	S	NS
		S. Ed. (\pm)	18.10	-	-	-	18.10	-
		C. D. (P = 0.05)	37.36	-	-	-	37.36	-

4.20. Comparative result of of *Pongamia pinnata* (Karanj) plantation at Rocky and Usar sites:

4.20.1. Increase in plant height (cm) of *Pongamia pinnata* (Karanj) at Rocky and Usar sites during two years (December, 2011 to November, 2013)

The data in respect of six month old seedling plant height are presented in Table 4.20.1. and fig. 4.20.1 it is clear from the table that there was significant different among plant height. The maximum (117.10cm) were found in T₁₀ (Vermicompost) 10 days irrigation schedule and followed by T₃ (107.64cm), T₁₁ (105.16cm) and T₄ (99.63cm), minimum were found in treatment T₀ (62.35cm) at Rocky sites. While the maximum (108.34cm) were found in T₁₀ (Vermicompost) 10 days irrigation schedule and followed by T₃ (94.35cm), T₁₁ (90.45cm) and T₄ (87.11cm), minimum were found in treatment T₀ (46.55cm) at Usar sites.

The data in respect of one year old seedling plant height are presented in Table 4.20.1.and fig. 4.20.1.it is clear from the table that there was significant different among plant height. The maximum (170.60cm) were found in T₁₀ (Vermicompost) 10 days irrigation schedule and followed by T₃ (159.32cm), T₁₁ (156.04cm) and T₄(152.04cm),and minimum were found in treatment T₀ (76.66cm) at Rocky sites. While the maximum (139.78cm) were found in T₁₀ (Vermicompost) 10 days irrigation schedule and followed by T₃ (138.67cm), T₁₁ (123.05cm) and T₄ (119.47cm), and minimum were found in treatment T₀ (61.09cm) at Usar sites.

The data in respect of two year old seedling plant height are presented in Table 4.20.1.and fig. 4.20.1.it is clear from the table that there was significant different among plant height. The maximum (139.78cm) were found in T₁₀ (Vermicompost) 10 days irrigation schedule and followed by T₃ (184.69cm), T₁₁ (184.57cm) and T₄ (172.70cm), and minimum (61.09cm) were found in treatment T₀ (control) at Rocky sites. While The maximum (193.67cm) were found in T₁₀ (Vermicompost) 10 days irrigation schedule and followed by T₃ (145.65cm), T₁₁ (134.00cm) and T₄ (129.05cm), and minimum were found in treatment T₀ (104.47cm) at Usar sites.

Table 4.20.1. Increase in plant height (cm) of Karanj (*Pongamia pinnata*) at Rocky and Usar sites during two years (December 2011, to November, 2013)

Treatment No.	Treatment		Increase in plant height (cm) of Karanj					
	Organic manure	Irrigation schedule	Six months old seedlings		One year old seedlings		Two years old seedlings	
			Rocky site	Usar site	Rocky site	Usar site	Rocky site	Usar site
T ₀	Control		62.35	46.55	76.66	61.09	104.47	67.33
T ₁	FYM	When required	95.00	84.00	149.12	113.30	164.93	126.00
T ₂	NC	When required	87.47	74.97	136.01	106.81	153.89	111.32
T ₃	VC	When required	107.64	94.35	159.32	138.67	184.69	145.65
T ₄	FYM	10 Days	99.63	87.11	152.04	119.47	172.70	129.05
T ₅	FYM	20 Days	91.93	79.97	141.35	107.98	162.09	118.47
T ₆	FYM	30 Days	75.03	62.60	105.87	85.16	130.45	89.03
T ₇	NC	10 Days	84.44	69.97	126.38	103.24	147.86	105.32
T ₈	NC	20 Days	80.33	66.41	117.35	97.40	141.44	98.56
T ₉	NC	30 Days	62.75	46.58	76.66	61.09	104.54	67.33
T ₁₀	VC	10 Days	117.10	108.34	170.60	139.78	193.67	156.33
T ₁₁	VC	20 Days	105.16	90.45	156.04	123.05	184.57	134.00
T ₁₂	VC	30 Days	69.23	58.95	90.80	73.62	116.83	81.64
		F- test	S	S	S	S	S	S
		S. Ed. (\pm)	9.60	10.43	13.40	8.58	14.43	20.52
		C. D. (P = 0.05)	19.81	21.53	27.66	17.71	29.79	42.36

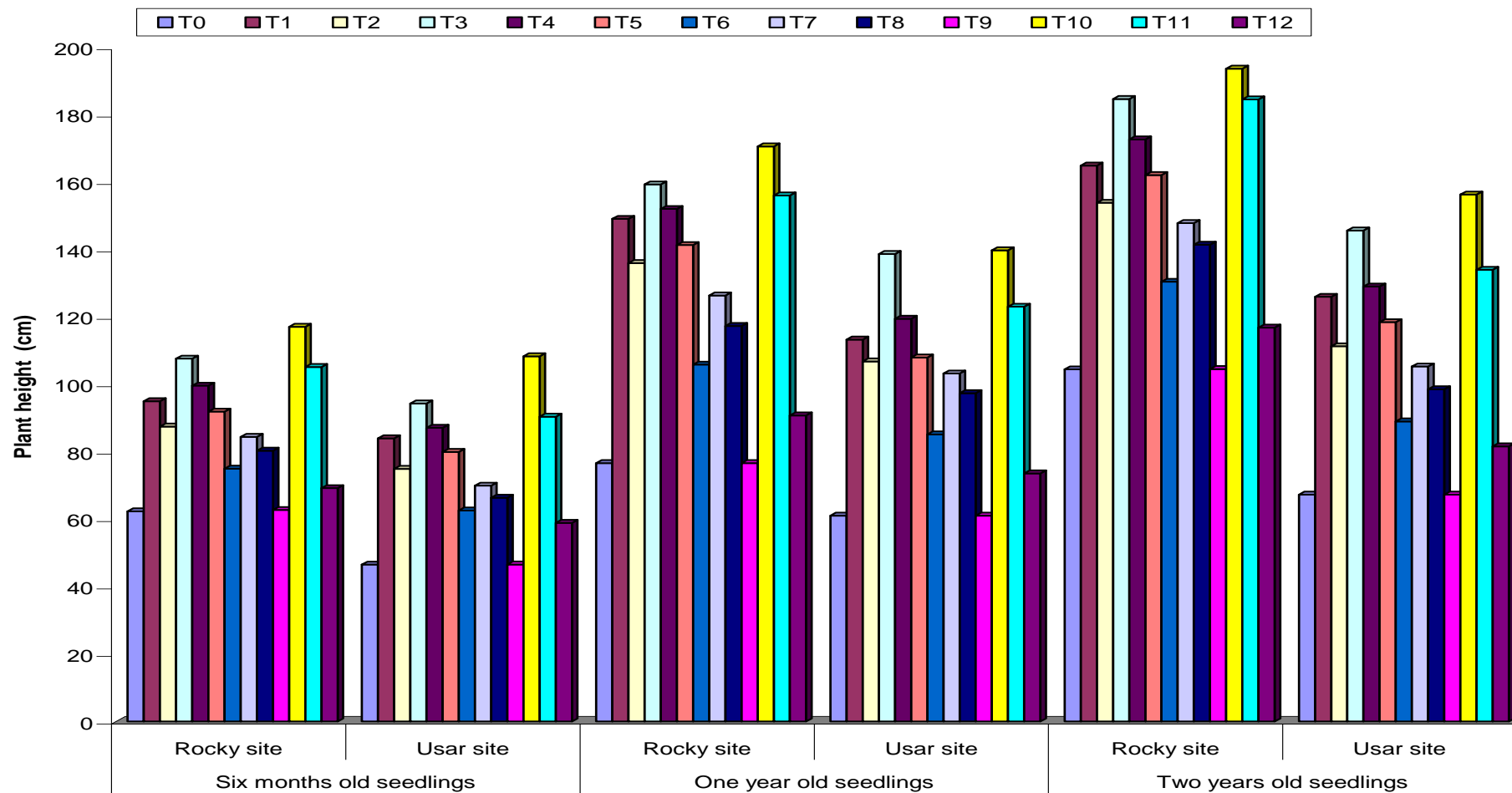


Fig. 4.20.1. Increase in plant height (cm) of Karanj at Rocky and Usar sites during two years (December, 2011 to November, 2013)

4.2.2 Increase in collar diameter (cm) of *Pongamia pinnata* (Karanj) at Rocky and Usar sites during two years (December, 2011 to November, 2013)

The data in respect of six month old seedling collar diameter are presented in Table 4.2.2 and fig. 4.2.2 it is clear from the table that there was significant different among plant height. The maximum increase collar diameter (10.79cm) were found in T₁₀ (Vermicompost) with 10 days irrigation schedule and followed by T₃ (10.14cm), T₁₁ (9.91cm) and T₄ (9.47cm) and minimum increase collar diameter (4.98cm) were found in treatment T₀ (control) at Rocky sites. While as the maximum increase collar diameter (8.02cm) were found in T₁₀ (Vermicompost) with 10 days irrigation schedule and followed by T₃ (7.42cm), T₁₁ (7.01cm) and T₄ (6.75cm) and minimum were found in treatment T₀ (4.05cm) at Usar sites. While as other organic manure and irrigation schedule showed the significant differences in the plant collar diameter.

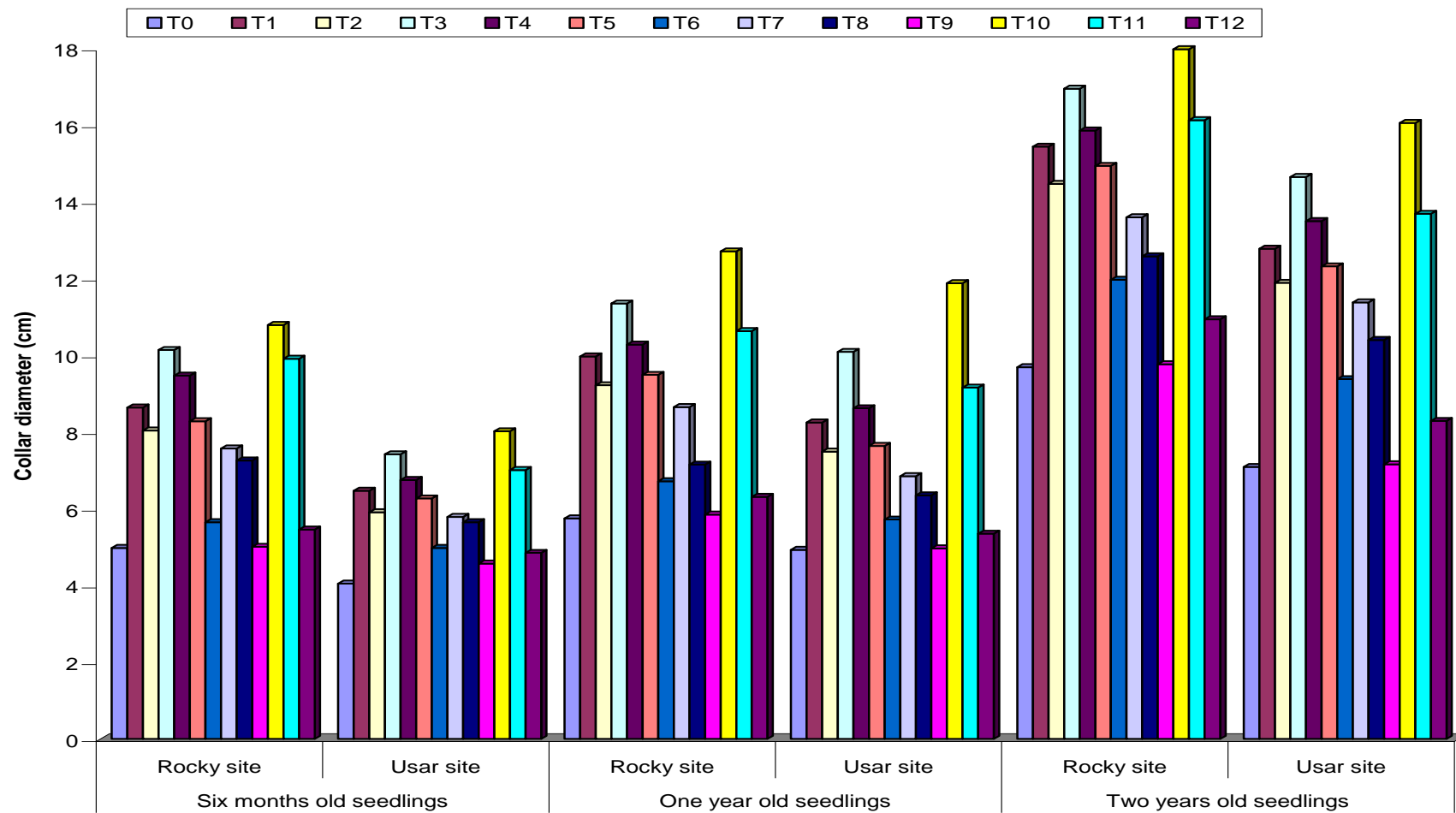
The data in respect of one year old seedling collar diameter are presented in Table 4.2.2 and fig. 4.2.2 it is clear from the table that there was significant different among plant height. The maximum increase collar diameter (12.71cm) were found in T₁₀ (Vermicompost) with 10 days irrigation schedule and followed by T₃ (11.35cm), T₁₁ (10.63cm) and T₄ (10.28cm) and minimum increase collar diameter (5.75cm) were found in treatment T₀ (control) at Rocky sites. While as the maximum increase collar diameter (11.88cm) were found in T₁₀ (Vermicompost) with 10 days irrigation schedule and followed by T₃ (10.09cm), T₁₁ (9.16cm) and T₄ (8.62cm) and minimum increase collar diameter were found in treatment T₀ (4.93cm) at Usar sites. While as other organic manure and irrigation schedule showed the significant differences in the plant collar diameter.

The data in respect of two year old seedling collar diameter are presented in Table 4.2.2 and fig. 4.2.2 it is clear from the table that there was significant different among plant height. The maximum (17.98cm) were found in T₁₀ (Vermicompost) with 10 days irrigation schedule and followed by T₃ (16.95cm), T₁₁ (16.13cm) and T₄ (15.86cm) and minimum were found in treatment T₀ (9.69cm) at Rocky sites. While the maximum increase collar diameter (16.06cm) were found in T₁₀ (Vermicompost) with 10 days irrigation schedule and followed by T₃ (14.65cm), T₁₁ (13.69cm) and T₄ (13.50cm) and minimum increase collar diameter were found in treatment T₀ (7.09cm)

at Usar sites. While as other organic manure and irrigation schedule showed the significant differences in the plant collar diameter.

Table 4.20.2. Increase in collar diameter (cm) of Karanj (*Pongamia pinnata*) at Rocky and Usar sites during two years (December, 2011 to November, 2013)

Treatment No.	Treatment		Increase in collar diameter (cm) of Karanj					
	Organic manure	Irrigation schedule	Six months old seedlings		One year old seedlings		Two years old seedlings	
			Rocky site	Usar site	Rocky site	Usar site	Rocky site	Usar site
T ₀	Control		4.98	4.05	5.75	4.93	9.69	7.09
T ₁	FYM	When required	8.64	6.47	9.97	8.25	15.44	12.78
T ₂	NC	When required	8.04	5.91	9.22	7.49	14.47	11.89
T ₃	VC	When required	10.14	7.42	11.35	10.09	16.95	14.65
T ₄	FYM	10 Days	9.47	6.75	10.28	8.62	15.86	13.50
T ₅	FYM	20 Days	8.28	6.27	9.49	7.64	14.94	12.32
T ₆	FYM	30 Days	5.65	4.98	6.72	5.72	11.97	9.38
T ₇	NC	10 Days	7.57	5.79	8.65	6.85	13.60	11.38
T ₈	NC	20 Days	7.26	5.65	7.15	6.35	12.58	10.40
T ₉	NC	30 Days	5.01	4.57	5.85	4.97	9.77	7.16
T ₁₀	VC	10 Days	10.79	8.02	12.71	11.88	17.98	16.06
T ₁₁	VC	20 Days	9.91	7.01	10.63	9.16	16.13	13.69
T ₁₂	VC	30 Days	5.46	4.85	6.31	5.35	10.94	8.29
		F- test	S	S	S	S	S	S
		S. Ed. (\pm)	1.12	0.89	1.20	0.91	1.23	2.24
		C. D. (P = 0.05)	2.32	1.83	2.48	1.88	2.55	4.63



4.20.2. Increase in collar diameter (cm) of Karanj at Rocky and Usar sites during two years (December, 2011 to November, 2013)

4.20.3. Survival percentage of *Pongamia pinnata* (Karanj) at Rocky and Usar sites during two years (December, 2011 to November, 2013)

The survivability of six month, one year and two year old Karanj seedlings grown at rocky and Usar sites with different intervals of irrigation schedule along with the applications of organic manures available or provide in a form of different treatment combinations.

The study clearly indicates non significant maximum survival percentage i.e. 100% was found in T₁, T₂, T₃, T₄ T₅, T₇, T₈, T₁₀, T₁₁ and except T₆ and T₁₂ six month at rocky and T₁₂ six month usar and one year rocky, due to good soil condition, nature of soil fertility availability essential minerals & nutrients, proper and good health condition of karanj seedlings and its adaptability. This followed T₆ six month rocky, T₁₂ six month usar and rocky and one year rocky and T₉ with 66.67 percent except and treatment T₀ (control) which shows (33.33%) minimum survival percentage of karanj seedlings because of some deficiencies are found present in usar site or decrease in physical nature of soil. Overall it is observed that treatment T₁₀ (vermicompost @ 10 days of irrigation schedule) with maximum survivability or survival % i.e. 100@ along with other attributes or observatory parameters would consider the best treatment combination.

Table 4.20.3. Survival percentage of Karanj (*Pongamia pinnata*) at Rocky and Usar sites during two years (December, 2011 to November, 2013)

Treatment No.	Treatment		Survival percentage of Karanj					
	Organic manure	Irrigation schedule	Six months old seedlings		One year old seedlings		Two years old seedlings	
			Rocky site	Usar site	Rocky site	Usar site	Rocky site	Usar site
T ₀	Control		33.33	33.33	33.33	33.33	33.33	33.33
T ₁	FYM	When required	100.00	100.00	100.00	100.00	100.00	100.00
T ₂	NC	When required	100.00	100.00	100.00	100.00	100.00	100.00
T ₃	VC	When required	100.00	100.00	100.00	100.00	100.00	100.00
T ₄	FYM	10 Days	100.00	100.00	100.00	100.00	100.00	100.00
T ₅	FYM	20 Days	100.00	100.00	100.00	100.00	100.00	100.00
T ₆	FYM	30 Days	66.67	100.00	100.00	100.00	100.00	100.00
T ₇	NC	10 Days	100.00	100.00	100.00	100.00	100.00	66.67
T ₈	NC	20 Days	100.00	100.00	100.00	100.00	100.00	100.00
T ₉	NC	30 Days	66.67	66.67	66.67	66.67	66.67	66.67
T ₁₀	VC	10 Days	100.00	100.00	100.00	100.00	100.00	100.00
T ₁₁	VC	20 Days	100.00	100.00	100.00	100.00	100.00	100.00
T ₁₂	VC	30 Days	66.67	66.67	66.67	100.00	100.00	66.67
		F- test	NS	NS	NS	S	S	NS
		S. Ed. (\pm)	-	-	-	18.10	18.10	-
		C. D. (P = 0.05)	-	-	-	37.36	37.36	-

4.21. Comparative results of *Emblica officinalis* (Aonla) at Rocky and Usar sites:

4.21.1. Increase in plant height (cm) of *Emblica officinalis* (Aonla) at Rocky and Usar sites during two years (December, 2011 to November, 2013)

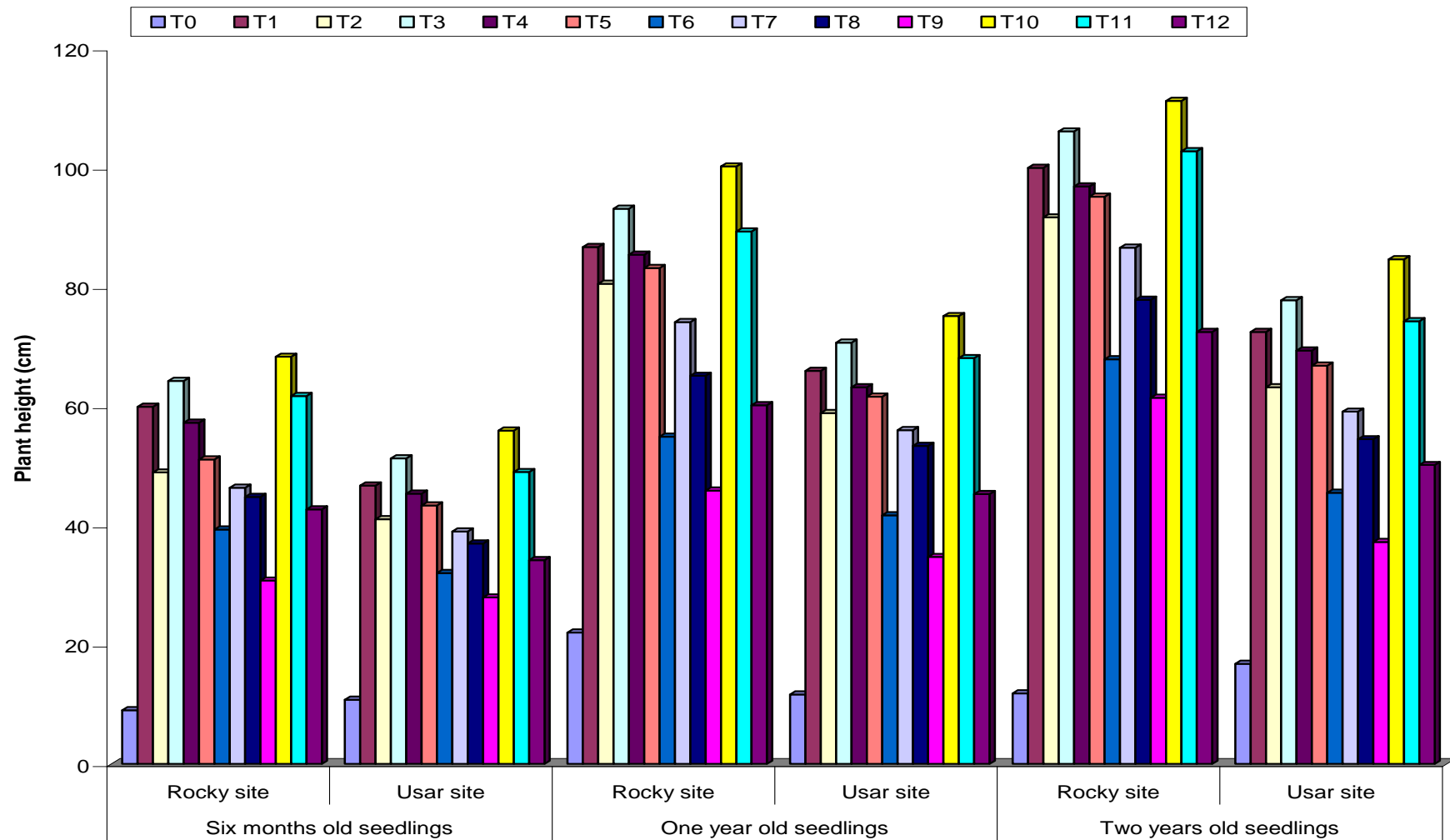
The data in respect of six month old seedling plant height are presented in Table 4.21.1. and fig. 4.21.1. it is clear from the table that there was significant different among plant height. The maximum (68.30cm) were found in T₁₀ (Vermicompost) with 10 days irrigation schedule and followed by T₃ (64.23cm), T₁₁ (61.72cm) and T₄ (57.23cm) and minimum were found in treatment T₀ (9.00cm) at Rocky sites. While the maximum (55.90cm) were found in T₁₀ (Vermicompost) with 10 days irrigation schedule and followed by T₃ (51.25cm), T₁₁ (48.96cm) and T₄ (45.34cm) and minimum were found in treatment T₀ (10.78cm) at Usar sites.

The data in respect of one year old seedling plant height are presented in Table 4.21.1. and fig. 4.21.1. it is clear from the table that there was significant different among plant height. The maximum (100.22cm) were found in T₁₀ (Vermicompost) with 10 days irrigation schedule and followed by T₃ (93.13cm), T₁₁ (89.31cm) and T₄ (85.42cm) and minimum were found in treatment T₀ (22.03cm) at Rocky sites. While the maximum (75.12cm) were found in T₁₀ (Vermicompost) with 10 days irrigation schedule and followed by T₃ (70.66cm), T₁₁ (68.07cm) and T₄ (63.17cm) and minimum were found in treatment T₀ (11.65cm) at Usar sites.

The data in respect of two month old seedling plant height are presented in Table 4.21.1. and fig. 4.21.1. it is clear from the table that there was significant different among plant height. The maximum (111.21cm) were found in T₁₀ (Vermicompost) with 10 days irrigation schedule and followed by T₃ (106.09cm), T₁₁ (102.76cm) and T₄ (96.85cm) and minimum were found in treatment T₀ (11.85cm) at Rocky sites. While the maximum (84.63cm) were found in T₁₀ (Vermicompost) with 10 days irrigation schedule and followed by T₃ (77.79cm), T₁₁ (74.26cm) and T₄ (69.33cm) and minimum were found in treatment T₀ (16.78cm) at Usar sites.

Table 4.21.1. Increase in plant height (cm) of Aonla (*Emblica officinalis*) at Rocky and Usar sites during two years (December, 2011 to November, 2013)

Treatment No.	Treatment		Increase in plant height (cm) of Aonla					
	Organic manure	Irrigation schedule	Six months old seedlings		One year old seedlings		Two years old seedlings	
			Rocky site	Usar site	Rocky site	Usar site	Rocky site	Usar site
T ₀	Control		9.00	10.78	22.03	11.65	11.85	16.78
T ₁	FYM	When required	59.90	46.71	86.69	65.93	99.98	72.47
T ₂	NC	When required	48.88	41.04	80.53	58.85	91.67	63.17
T ₃	VC	When required	64.23	51.25	93.13	70.66	106.09	77.79
T ₄	FYM	10 Days	57.23	45.34	85.42	63.17	96.85	69.33
T ₅	FYM	20 Days	51.05	43.37	83.17	61.59	95.14	66.81
T ₆	FYM	30 Days	39.32	32.01	54.88	41.72	67.86	45.48
T ₇	NC	10 Days	46.32	39.00	74.10	55.98	86.59	59.08
T ₈	NC	20 Days	44.79	36.98	65.10	53.35	77.84	54.46
T ₉	NC	30 Days	30.75	27.93	45.86	34.72	61.42	37.23
T ₁₀	VC	10 Days	68.30	55.90	100.22	75.12	111.21	84.63
T ₁₁	VC	20 Days	61.72	48.96	89.31	68.07	102.76	74.26
T ₁₂	VC	30 Days	42.70	34.20	60.17	45.26	72.46	50.13
		F- test	S	S	S	S	S	S
		S. Ed. (\pm)	15.06	7.43	4.14	12.57	3.96	5.13
		C. D. (P = 0.05)	31.09	15.33	8.54	25.95	8.17	10.59



4.21.1. Increase in plant height (cm) of Aonla at Rocky and Usar sites in December, 2011 to November, 2013

4.21.2. Increase in collar diameter (cm) of *Embblica officinalis* (Aonla) at Rocky and Usar sites during two years (December, 2011 to November, 2013)

The data in respect of six month old seedling collar diameter are presented in Table 4.21.2. and fig. 4.21.2. it is clear from the table that there was significant different among plant height. The maximum increase collar diameter (9.56cm) were found in T₁₀ (VC 10 days irrigation schedule) and followed by T₃ (7.87cm), T₁₁ (7.74cm) and T₄ (6.82cm) and minimum increase collar diameter (2.16cm) were found in treatment T₀ (control) at Rocky sites. While the maximum increase collar diameter (7.79cm) were found in T₁₀ (Vermicompost) with 10 days irrigation schedule and followed by T₃ (6.87cm), T₁₁ (6.23cm) and T₄ 5.70cm) and minimum increase collar diameter (2.11cm) were found in treatment T₀ (control) at Usar sites. While as other organic manure and irrigation schedule showed the significant differences in the plant collar diameter.

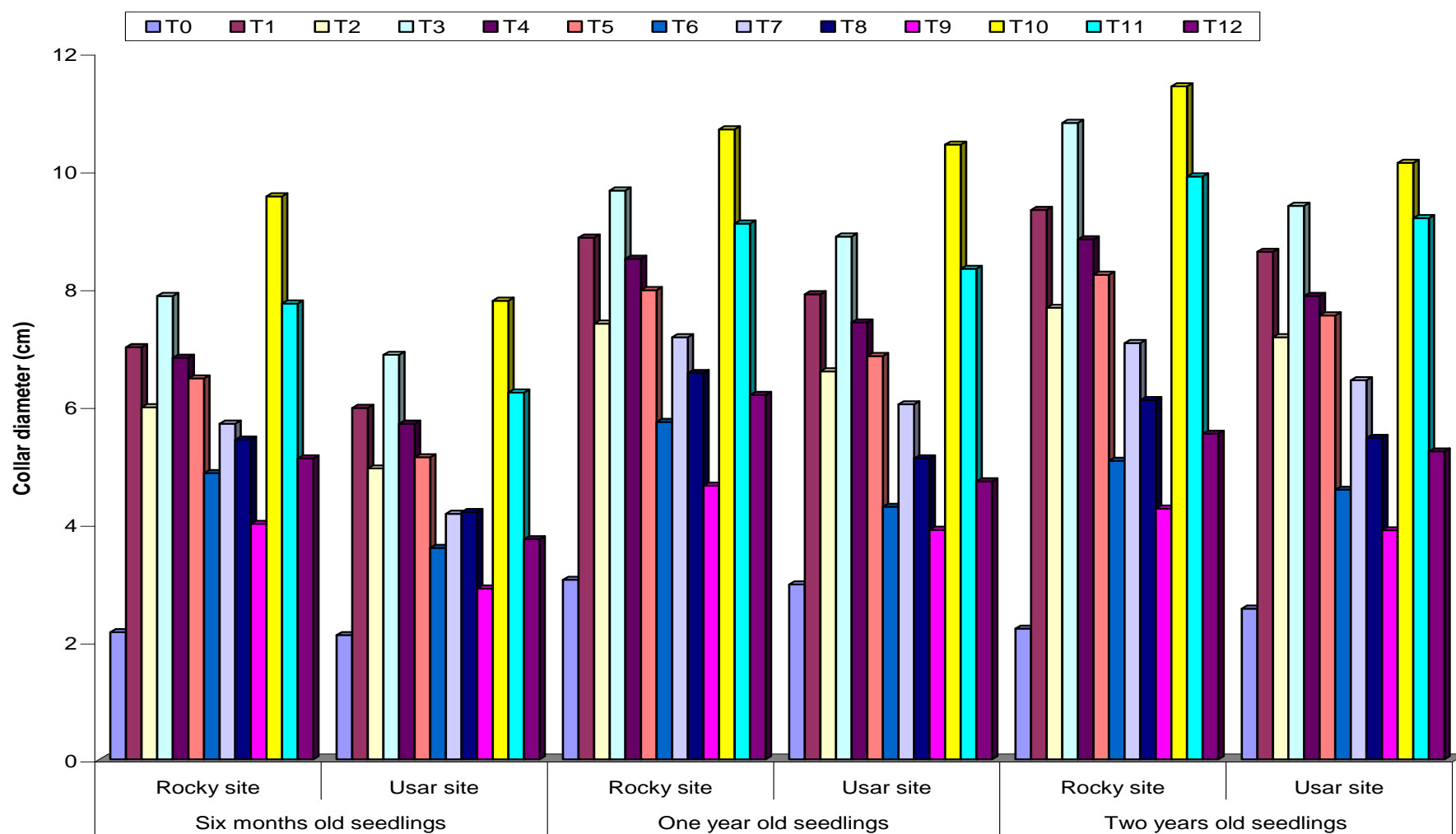
The data in respect of one year old seedling collar diameter are presented in Table 4.21.2. and fig. 4.21.2. it is clear from the table that there was significant different among plant height. The maximum (10.70cm) were found in T₁₀ (Vermicompost) with 10 days irrigation schedule and followed by T₃ (9.66cm), T₁₁ (9.10cm) and T₄ (8.50cm) and minimum increase collar diameter were found in treatment T₀ (3.05cm) at Rocky sites. While the maximum increase collar diameter (10.44cm) were found in T₁₀ (Vermicompost) with 10 days irrigation schedule and followed by T₃ (8.88cm), T₁₁ (8.33cm) and T₄ (7.42cm) and minimum were found in treatment T₀ (2.97cm) at Usar sites. While as other organic manure and irrigation schedule showed the significant differences in the plant collar diameter.

The data in respect of two year old seedling collar diameter are presented in Table 4.1.2 and fig. 4.21.2. it is clear from the table that there was significant different among plant height. The maximum increase collar diameter (11.43cm) were found in T₁₀ (Vermicompost) with 10 days irrigation schedule and followed by T₃ (10.81cm), T₁₁ (9.90cm) and T₄ (8.83cm) and minimum were found in treatment T₀ (2.22cm) at Rocky sites. While the maximum (10.13cm) were found in T₁₀ (VC 10 days irrigation schedule) and followed by T₃ (9.40cm), T₁₁ (9.19cm) and T₄ (7.87cm) and minimum increase collar diameter were found in treatment T₀ (2.56cm) at Usar sites. While as

other organic manure and irrigation schedule showed the significant differences in the plant collar diameter.

Table 4.21.2. Increase in collar diameter (cm) of Aonla (*Emblca officinalis*) at Rocky and Usar sites during two years (December, 2011 to November, 2013)

Treatment No.	Treatment		Increase in collar diameter (cm) of Aonla					
	Organic manure	Irrigation schedule	Six months old seedlings		One year old seedlings		Two years old seedlings	
			Rocky site	Usar site	Rocky site	Usar site	Rocky site	Usar site
T ₀	Control		2.16	2.11	3.05	2.97	2.22	2.56
T ₁	FYM	When required	7.00	5.97	8.86	7.90	9.33	8.62
T ₂	NC	When required	5.98	4.94	7.40	6.59	7.67	7.17
T ₃	VC	When required	7.87	6.87	9.66	8.88	10.81	9.40
T ₄	FYM	10 Days	6.82	5.70	8.50	7.42	8.83	7.87
T ₅	FYM	20 Days	6.47	5.13	7.97	6.85	8.23	7.54
T ₆	FYM	30 Days	4.86	3.59	5.73	4.29	5.07	4.58
T ₇	NC	10 Days	5.70	4.17	7.17	6.03	7.07	6.44
T ₈	NC	20 Days	5.43	4.20	6.56	5.11	6.10	5.46
T ₉	NC	30 Days	4.00	2.90	4.65	3.90	4.26	3.89
T ₁₀	VC	10 Days	9.56	7.79	10.70	10.44	11.43	10.13
T ₁₁	VC	20 Days	7.74	6.23	9.10	8.33	9.90	9.19
T ₁₂	VC	30 Days	5.11	3.74	6.19	4.72	5.53	5.23
		F- test	S	S	S	S	S	S
		S. Ed. (±)	1.89	1.09	0.78	1.40	0.53	0.70
		C. D. (P = 0.05)	3.91	2.25	1.62	2.88	1.10	1.43



4.21.2. Increase in collar diameter (cm) of Aonla at Rocky and Usar sites during December, 2011 to November, 2013.

4.21.3. Survival percentage of *Emblica officinalis* (Aonla) at Rocky and Usar sites during two years (December, 2011 to November, 2013)

The survivality of six month, one year and two year old aonla seedlings grown at rocky and usar sites with different intervals of irrigation schedule along with the applications of organic manures available or provide in a form of different treatment combinations.

The study clearly indicates non significant maximum survival percentage i.e. 100% was found in T₃ and T₁₀ in both sites due to good soil condition, nature of soil fertility availability essential minerals & nutrients, proper and good health condition of aonla seedlings and its adaptability. This followed in six month old seedling T₁, T₂, T₄, T₅, T₇, T₈, T₁₁, T₁₂ at rocky and T₂ in usar sites, in one year old seedling T₆, T₉ at rocky and T₀, T₂, T₅, T₆, T₇, T₈, T₉ and T₁₂, in two year old seedling T₉ in rocky and T₆, T₉ in usar with 66.67 percent and treatment shows minimum survival percentage 33.33 in six month old seedling T₀, T₆, T₉ at rocky and T₀, T₆, T₇, T₈, T₉, T₁₂ in usar sites, in one year old seedling T₀ at rocky, in two year old seedling T₀ in rocky and usar of aonla seedlings because of some deficiencies are found present in usar site or decrease in physical nature of soil. Overall it is observed that treatment T₁₀ (Vermicompost) with 10 days irrigation schedule with maximum survivality or survival percentage i.e. 100% along with other attributes or observatory parameters would consider the best treatment combination.

Table 4.21.3. Survival percentage of Aonla (*Embllica officinalis*) at Rocky and Usar sites during two years (December, 2011 to November, 2013)

Treatment No.	Treatment		Survival percentage of Aonla					
	Organic manure	Irrigation schedule	Six months old seedlings		One year old seedlings		Two years old seedlings	
			Rocky site	Usar site	Rocky site	Usar site	Rocky site	Usar site
T ₀	Control		33.33	33.33	33.33	66.67	33.33	33.33
T ₁	FYM	When required	66.67	100.00	100.00	100.00	100.00	100.00
T ₂	NC	When required	66.67	66.67	100.00	66.67	100.00	100.00
T ₃	VC	When required	100.00	100.00	100.00	100.00	100.00	100.00
T ₄	FYM	10 Days	66.67	100.00	100.00	100.00	100.00	100.00
T ₅	FYM	20 Days	66.67	100.00	100.00	66.67	100.00	100.00
T ₆	FYM	30 Days	33.33	33.33	66.67	66.67	100.00	66.67
T ₇	NC	10 Days	66.67	33.33	100.00	66.67	100.00	100.00
T ₈	NC	20 Days	66.67	33.33	100.00	66.67	100.00	100.00
T ₉	NC	30 Days	33.33	33.33	66.67	66.67	66.67	66.67
T ₁₀	VC	10 Days	100.00	100.00	100.00	100.00	100.00	100.00
T ₁₁	VC	20 Days	66.67	100.00	100.00	100.00	100.00	100.00
T ₁₂	VC	30 Days	66.67	33.33	100.00	66.67	100.00	100.00
		F- test	NS	S	NS	NS	S	NS
		S. Ed. (±)	-	26.15	-	-	18.10	-
		C. D. (P = 0.05)	-	53.97	-	-	37.36	-

4.22. Soil Ananalysis:

4.22.1. Soil Analysis of Rocky soil before after Plantation -

		Soil Analysis before plantation	Soil analysis after plantation		
SI No.	Parameters		Rocky + Vermicompost	Rocky + Neem Cake	Rocky + FYM
1	pH	6.28	6.9	7.1	8
2	Electric conductivity(dsm^{-1})	0.182	0.19	0.157	0.19
3	Organic carbon (% per ha.)	0.45	1.3	0.65	2.4
4	Nitrogen (Kg per ha.)	170.2	500	198	358
5	Phosphorous (Kg per ha)	8.3	38.3	9.5	31.7
6	Potassium (Kg per ha.)	70	275	98	220

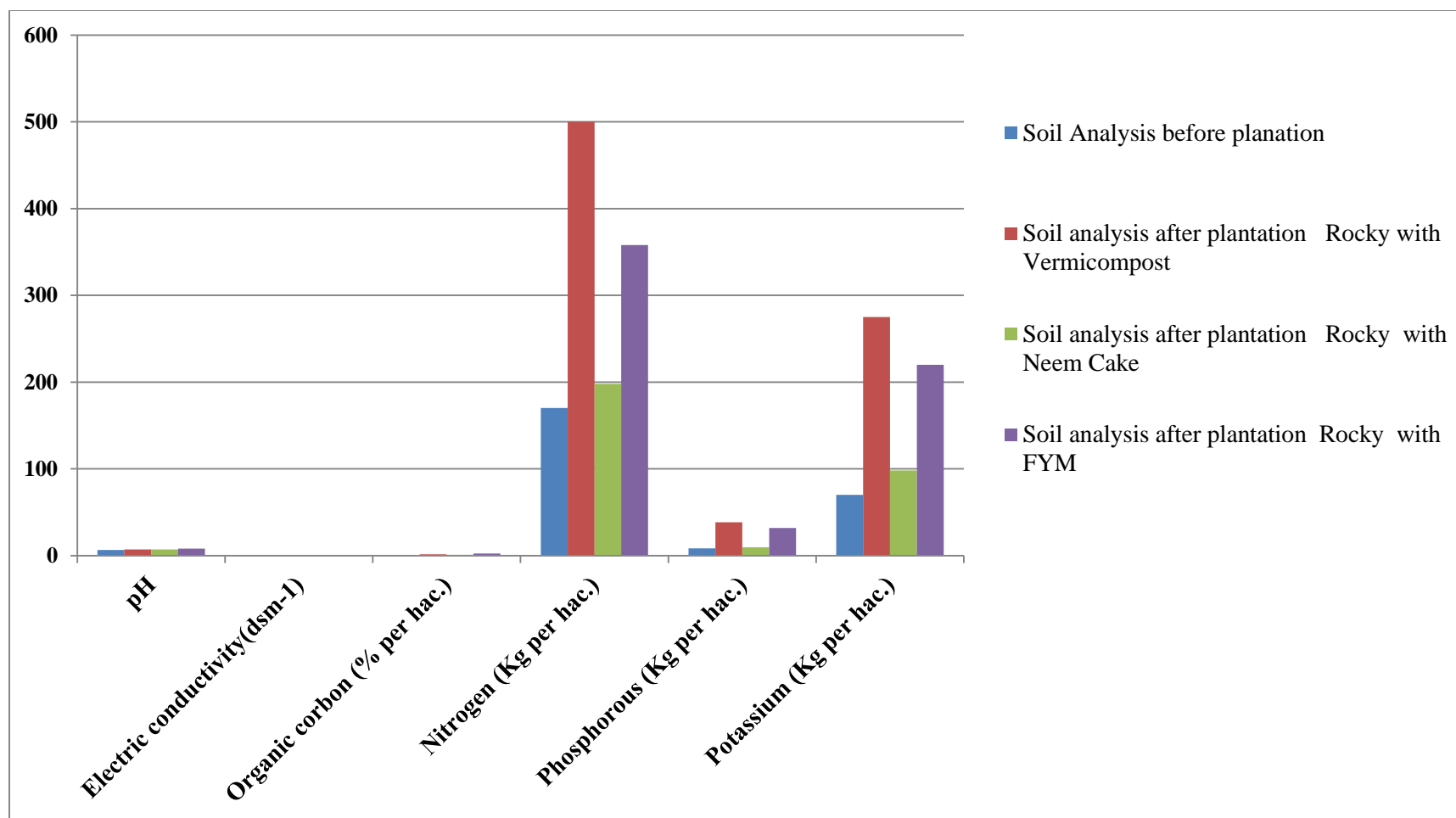


Fig. 4.22.1 Soil Analysis before and after Plantation in rocky soil.

4.22.1. The plantation of Rocky soil plantation some values are increase or decrease due to soil fertility value. The physiochemical status of soil checks before and after plantation at two different sites of *Pangomia*, *Carrissa*, *Emblica* tree species.

The pH value decrease from before plantation (6.28). In vermicompost (6.9) and FYM plantation is (8.0) and in Need cake plantation is (7.1) According to fertility level it attains medium fertility class after plantation.

Electric conductivity was increase after plantation. It is good character of humid soil therefore it attains the nearest normal fertility class of soil. The electric conductivity values of Vermicompost (0.19dS/m), Neem cake (0.157dS/m) and FYM (0.19dS/m) plantation.

Organic carbon was increase from before plantation. More organic carbon was found in FYM (2.4%) plantation followed by Vermicompost (1.3%) and Neem cake (0.65%). On fertility scale vermicompost and FYM showed high fertility and Neem cake covers medium fertility scale.

Nitrogen amount was increase after plantation from before plantation. Vermicompost (500 kg/ha) and FYM (358 kg/ha) covers medium fertility class. While Need cake (198 kg/ha) showed low fertility class.

Phosphorus was higher in value after plantation Vermicompost (38.3 kg/ha) and FYM (31.7kg/ha) covers high fertility class. While Need cake (9.5 kg/ha) showed low fertility class.

Potassium was in increase value due to organic manure application. The value was less in Need cake Plantation (98 kg/ha) so showed low fertility class. While in Vermicompost (275 kg/ha) plantation and FYM (220 kg/ha) plantation showed medium fertility class.

4.22.2.. Soil Analysis of Usar soil before and after Plantation -

		Soil Analysis before plantation	Soil analysis after plantation		
Sl No.	Parameters		Rocky + Vermicompost	Rocky + Neem Cake	Rocky + FYM
1	pH	7.28	7	7.2	7
2	Electric conductivity(dsm ⁻¹)	0.152	0.18	0.186	0.16
3	Organic carbon (% per ha.)	0.3	0.9	0.45	1.8
4	Nitrogen (Kg per ha.)	143	410	160	285
5	Phosphorous (Kg per ha)	7.8	32.2	8.5	184
6	Potassium (Kg per ha.)	65	240	85	190

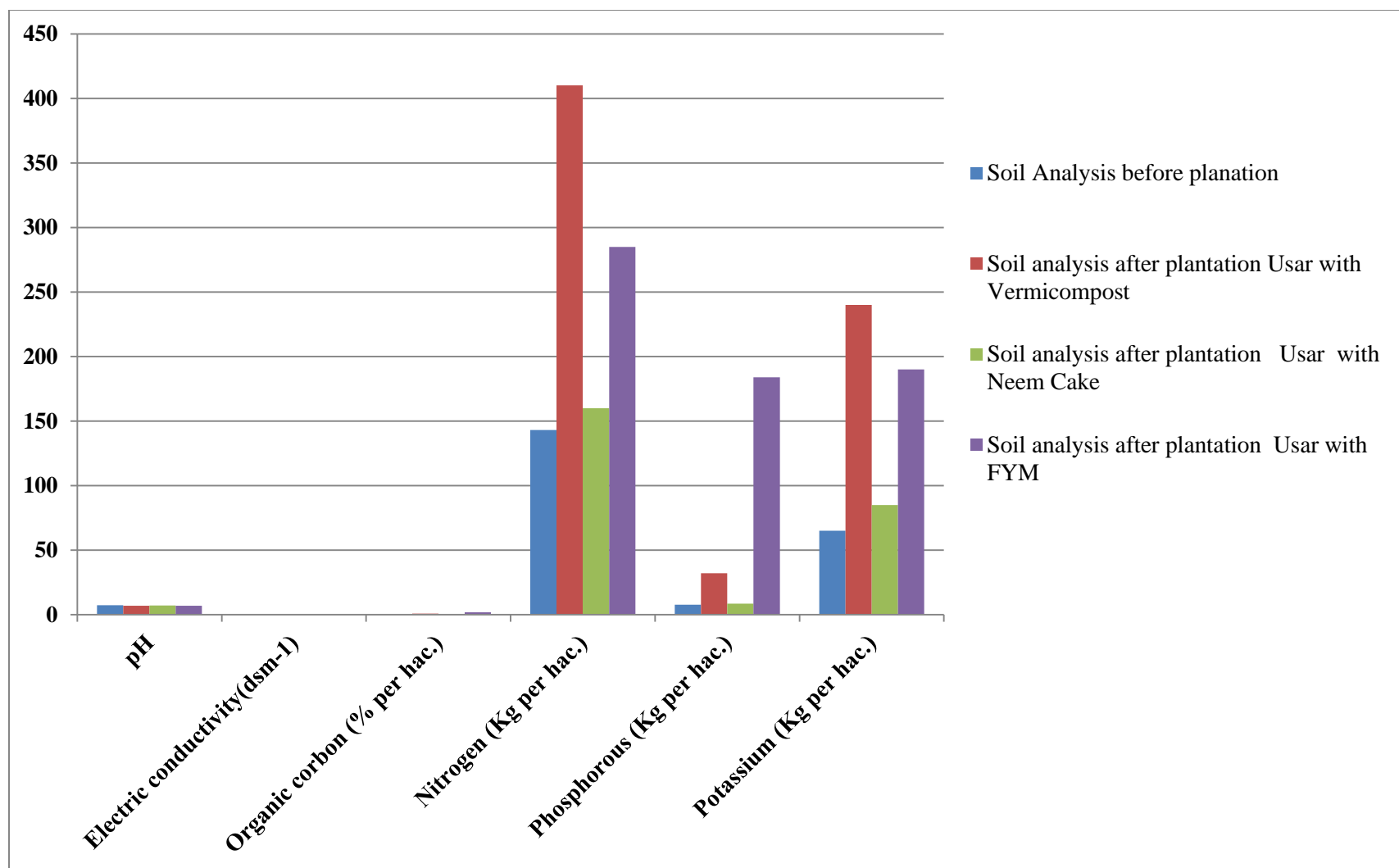


Fig. 4.22.2. Soil Analysis before and after Plantation in usar soil.

4.22.2. The plantation of usar soil plantation some values are increase or decrease due to soil fertility value. The physiochemical status checks before and after plantation at two different sites of *Pangomia*, *Carrissa*, *Emblica* tree species.

The pH value decrease from before plantation (7.28). In vermicompost and FYM plantation is 7.0 and in Need cake plantation is 7.2. According to fertility level it attains medium fertility class after plantation.

Electric conductivity was increase after plantation. It is good character of humid soil therefore it attains the nearest normal fertility class of soil. The electric conductivity values of Vermicompost (0.18dS/m), Neem cake (0.186dS/m) and FYM (0.16dS/m) plantation.

Organic carbon was increase from before plantation .more organic carbon was found in FYM (1.8%) plantation followed by Vermicompost (0.9%) and Neem cake (0.45%).On fertility scale vermicompost showed medium fertility and Neem cake covers low fertility scale while FYM was in high fertility class.

Nitrogen amount was increase after plantation from before plantation. Vermicompost (410 kg/ha) and FYM (285 kg/ha) covers medium fertility class. While Need cake (160 kg/ha) showed low fertility class.

Phosphorus was higher in value after plantation Vermicompost (32.5 kg/ha) and FYM (184 kg/ha) covers high fertility class. While Need cake (8.5 kg/ha) showed low fertility class.

Potassium was in increase value due to organic manure application. The value was less in Need cake Plantation (85 kg/ha) so showed low fertility class. While in Vermicompost (240 kg/ha) plantation and FYM (190 kg/ha) plantation showed medium fertility class.

The present study was conducted at Meja Tehsil, Allahabad during the month of December, 2011 to November, 2012 and December, 2012 to November, 2013 on two sites based three tree species under three age group of seedlings with in Allahabad of Uttar Pradesh under the title “**Assessment of Plant Species for Rehabilitation of wasteland in Meja Tehsil**” discuss below-

5.1. *Carissa carandas* (Karondha) –

5.1.1 Increase in plant height (cm) of *Carissa carandas* (Karondha) – 6 month, one year and two year old seedling at Rocky and usar site in December, 2011 to November, 2013.

The statistical analysis of plant height of *Carissa carandas* of 6 month old, one year and two year old seedling is given in the table 4.1.1, 4.10.1, 4.2.1, 4.11.1, 4.3.1 and 4.12.1 at rocky and usar site showed significant result in treatment T₁₀ (Vermicompost) with 10 days interval Irrigation . The improvements in plant growth and increases in yields could not be explained by the availability of macronutrients, because all vermicompost treatments were supplemented with inorganic fertilizers, to equalize macronutrient availability at transplanting time. Increases in growth may be due to increase in microbial biomass in soils receiving vermicomposts which increased nutrient mineralization. Moreover, increases in microbial biomass could have enhanced microbial competition which suppressed plant parasitic nematodes. These results are in accordance with the results of **Arancon *et al.*, 2002.**

The summarized statistical analysis of height of *Carissa carandas* seedling in given table 4.19.1. *C.carandus* is a slow growing species. This attempt to elucidate the response of two early succession species indicated considerable decline in survival and various growth parameters with increasing sodicity and salinity levels. These results are in accordance with the results of **Singh, (1994)** in which higher tolerance of *A. nilotica* seedlings was observed than those of *D. sissoo* seedlings to sodicity levels. This may be due to the difference in their root behavior and hardiness of these species to such adverse soil environment. About 50% reduction in control treatment of *D. sissoo* revealed poor tolerance of this species to salinity. On the other

hand, *A. nilotica* seedlings indicated only 25% reduction from the control treatment. Thus, *A. nilotica* is more tolerant to salinity as compared to *D. sissoo*. **Yadav and Singh (1970)**, while studying the performance of different species in salt-affected usar soils, have observed variability in the tolerance of *D. sissoo* and *A. nilotica* seedlings. **Singh and Yadav (1985)** and **Singh et al. (1988, 1991)** who observed better growth in *A. nilotica* than in *D. sissoo* under saline soils.

5.1.2. Increase in plant collar diameter (cm) of *Carissa carandas* (Karondha) – 6 month, one year and two year old seedling at Rocky and Usar site in December, 2011 to November, 2013.

The statistical analysis in tables 4.1.2, 4.10.2, 4.2.2, 4.11.2., 4.3.2, and 4.12.2, and figure also showed that significant at organic manure Vermicompost fertilizers on collar diameter on different age group (6 month, one year and two year old seedling) of plants. The highest collar diameter was recorded in T₁₀ (vermicompost) with 10 days irrigation interval followed by T₃ (vermicompost) and T₁₁ (vermicompost) with 20 days irrigation interval. The effect of vermicompost was better than the other organic manure. These results are in accordance with the results of **Reddy and Reddy (1999)** in petunia plant and reported significant increases in micronutrients in field soils after vermicompost applications compared to those in soils treated with animal manures. In other experiments, amounts of soil nitrogen increased significantly after incorporating vermicomposts into soils (**Sreenivas et al. 2000; Kale et al. 1992; Nethra et al. 1999**) and the amounts of P and K available also increased (**Venkatesh et al. 1998**).

The summarized statistical analysis in tables 4.19.2 and figure also showed that significant at organic manure Vermicompost fertilizers on collar diameter on different age group (6 month, one year and two year old seedling) of plants. The highest collar diameter was recorded in T₁₀ (vermicompost) with 10 days irrigation interval followed by T₃ (vermicompost) and T₁₁ (vermicompost) with 20 days irrigation interval. The effect of vermicompost was better than the other organic manure.

5.1.3. Survival Percentage of *Carissa carandas* (Karondha) – 6 month, one year and two year old seedling at Rocky and Usar site in December, 2011 to November, 2013.

The data presented in table 4.1.3, 4.10.3 (only first quarter) and 4.3.3, showed significant survival percentage. The maximum survival percentage 100% was found in two year old seedling in rocky site than usar site due to porosity of soil. Some showed non-significant result in table 4.1.3 (only first year growth), 4.10.3., 4.2.3, 4.11.3, 4.3.3 (only first and second quarter), and 4.12.3 This result was also proved by **Marak *et al.* (2017)** and suggested that it improved survivability due to increasing activity of microbes in soil and improvement of soil health. Organic fertilizers (FYM, vermicompost) also enhance plant survivability via improving soil structure, root biomass therefore metabolic activities also influence due to availability of food for microbes in organic content rich soil. Balanced use of fertilizers (RDF-recommended dose of fertilizers) enhances plant growth and development so that plant will survive easily and plants will be healthy.

Overall survival percentage during two year in table 4.19.3 showed significant result only in six month old seedling and two year old seedling at rocky sites and others were non-significant. This result was also proved that it improved survivability due to increasing activity of microbes in soil and improvement of soil health. Organic fertilizers (FYM, vermicompost) also enhance plant survivability via improving soil structure, root biomass therefore metabolic activities also influence due to availability of food for microbes in organic content rich soil. Balance use of fertilizers (RDF-recommended dose of fertilizers) enhances plant growth and development so that plant will survive easily and plants will be healthy.

5.2. *Pangamia pinnata* (Karanj) –

5.2.1 Increase in plant height (cm) of *Pangamia pinnata* (Karanj) – 6 month, one year and two year old seedling at Rocky and usar site in December, 2011 to November, 2013.

The statistical analysis of plant height of *Pangamia pinnata* of 6 month, one year and two year old seedling was given in the table 4.4.1, 4.13.1, 4.5.1, 4.14.1, 4.5.1 and 4.15.1 at rocky and usar site got significant result in treatment T₁₀ (Vermicompost) with 10 days interval irrigation. These results are in accordance with the rests of **Dominguez (2004)**, studied that the vermicompost is an important component of sustainable organic agriculture. Vermicompost fertilizers which have

been used in many countries. Vermicompost is rich in plant nutrients. Vermicompost is a microbiologically active organic material formed from the interactions between earthworms and microorganisms during the decomposition of organic material.

The summarized statistical analysis of height of *Pangamia pinnata* seedling in given table 4.20.1. This attempt to elucidate the response of two early succession species indicated considerable decline in survival and various growth parameters with increasing sodicity and salinity levels. This result is in line with findings of **Campos *et al.* (2009)** and **Abirami *et al.* (2010)** who suggested that Vermicompost provides adequate nutrients and enhances both physical properties and water holding capacity. Combined application of vermicompost and coco peat have too showed significant effect on seedling growth and plant biomass, perhaps due to the synergistic effect of both these factors. The coir dust was low in nutrients; mixed with vermicompost it provides a better growth medium for plant establishment. However, air filled porosity, easily available water and aeration of vermicompost and Farm Yard Manure were not at the recommended level which, in turn, limited root growth and lowered water-holding capacity. Therefore, medium with vermicompost and coco peat is better suited than vermicompost alone, because of its better physical properties and higher nutrient levels.

5.2.2. Increase in plant collar diameter (cm) of *Pangamia pinnata* (Karanj) – 6 month, one year and two year old seedling at Rocky and Usar site in December, 2011 to November, 2013.

The statistical analysis in tables 4.4.2, 4.13.2, 4.5.2, 4.14.2, 4.5.2 and 4.15.2 and figure also showed that significant at organic manure Vermicompost fertilizers on collar diameter on different age group (6 month, one year and two year old seedling) of plants. The highest collar diameter was recorded in T₁₀ (vermicompost) with 10 days irrigation interval followed by T₃ (vermicompost) and T₁₁ (vermicompost0 with 20 days irrigation interval. The effect of vermicompost was better than the other organic manure.

The statistical analysis in tables 4.20.2 and figure also showed that significant at organic manure Vermicompost fertilizers on collar diameter on different age group (6 month old, one year and two year old seedling) of plants. The highest collar diameter was recorded in T₁₀ (vermicompost)

with 10 days irrigation interval followed by T₃ (vermicompost) and T₁₁ (vermicompost) with 20 days irrigation interval. The effect of vermicompost was better than the other organic manure.

5.2.3. Survival Percentage of *Pangamia pinnata* (Karanj) – 6 month, one year and two year old seedling at Rocky and Usar site in December, 2011 to November, 2013.

The data of one year old usar soil plantation, presented in table 4.14.3, (only second year growth except I quarter) and also two year old plantation in table 4.5.3 (only second year growth quarter) showed significant survival percentage. The maximum survival percentage 100% was found in two year old seedling in rocky site than usar site due to porosity of soil.

Sometimes some showed non-significant result in table 4.4.3, 4.13.3, 4.5.3 and 4.15.3. This result was also proved and suggested that in previous it improved survivability due to increasing activity of microbes in soil and improvement of soil health. Organic fertilizers (FYM, vermicompost) also enhance plant survivability via improving soil structure, root biomass therefore metabolic activities also influence due to availability of food for microbes in organic content rich soil. Balance use of fertilizers (RDF-recommended dose of fertilizers) enhances plant growth and development so that plant will survive easily and plants will be healthy.

Overall survival percentage during two year in table 4.20.3 showed significant result only in one year old seedling in usar and two year old seedling at rocky sites and others were non-significant. Organic fertilizers (FYM, vermicompost) also enhance plant survivability via improving soil structure, root biomass therefore metabolic activities also influence due to availability of food for microbes in organic content rich soil. Balance use of fertilizers (RDF-recommended dose of fertilizers) enhances plant growth and development so that plant will survive easily and plants will be healthy

5.3. *Emblica officinalis* (Aonla) –

5.3.1 Increase in plant height (cm) of *Emblica officinalis* (Aonla) – 6 month, one year and two year old seedling at Rocky and usar site in December, 2011 to November, 2013.

The statistical analysis of plant height of *Pangamia pinnata* of 6 month, one year and two year old seedling is given in the table 4.7.1, 4.15.1, 4.8.1, 4.17.1, 4.9.1, and 4.18.1 at rocky and usar sites showed significant result in treatment T₁₀ (Vermicompost) with 10 days interval

Irrigation. **Jo IS (1990)**, also found that Vermicompost granules may develop soil aggregation and its granulation. Soil aggregation will improve permeability and air flow in the polybags. Vermicompost may decrease fluctuation of soil temperature further root initiation and root growth become easier to the particular depth so that plant grows well and may absorb more water and nutrients.

The summarized statistical analysis of height of *Pangamia pinnata* seedling in given table 4.21.1. This attempt to elucidate the response of two early succession species indicated considerable decline in survival and various growth parameters with increasing sodacity and salinity levels. The coir dust was low in nutrients; mixed with vermicompost it provides a better growth medium for plant establishment. However, air filled porosity, easily available water and aeration of vermicompost and Farm Yard Manure were not at the recommended level which, in turn, limited root growth and lowered water-holding capacity. Therefore, medium with vermicompost and coco peat is better suited than vermicompost alone, because of its better physical properties and higher nutrient levels.

5.3.2. Increase in plant collar diameter (cm) of *Emblica officinalis* (Aonla) – 6 month, one year and two year old seedling at Rocky and Usar site in December, 2011 to November, 2013.

The statistical analysis in tables 4.7.2, 4.15.2, 4.8.2, 4.17.2, 4.9.2, and 4.18.2 and figure also showed that significant at organic manure Vermicompost fertilizers on collar diameter on different age group (6 month, one year and two year old seedling) of plants. The highest collar diameter was recorded in T₁₀ (vermicompost) with 10 days irrigation interval followed by T₃ (vermicompost) and T₁₁ (vermicompost) with 20 days irrigation interval. The effect of vermicompost was better than the other organic manure. This same result was discussed earlier found in petunia plant and reported significant increases in micronutrients in field soils after vermicompost applications compared to those in soils treated with animal manures.

The summarised statistical analysis in tables 4.21.2 and figure also showed that significant at organic manure Vermicompost fertilizers on collar diameter on different age group (6 month, one year and two year old seedling) of plants. The highest collar diameter was recorded in T₁₀ (vermicompost) with 10 days irrigation interval followed by T₃ (vermicompost) and T₁₁

(vermicompost) with 20 days irrigation interval. The effect of vermicompost was better than the other organic manure.

5.3.3. Survival Percentage of *Emblica officinalis* (Aonla) – 6 month, one year and two year old seedling at Rocky and Usar site in December, 2011 to November, 2013.

The data of one year old usar soil plantation, presented in table 4.15.3, (only second year growth quarter) and also two year old plantation in table 4.9.3 (only second year growth quarter) showed significant survival percentage. The maximum survival percentage 100% was found in two year old seedling in rocky site than usar site due to porosity of soil.

Sometimes some showed non-significant result in table 4.7.3, 4.8.3, 4.17.3, 4.9.3 (only first year growth quarter) and 4.18.3. This result was also proved and discussed that it improved survivability due to increasing activity of microbes in soil and improvement of soil health. Organic fertilizers (FYM, vermicompost) also enhance plant survivability via improving soil structure, root biomass therefore metabolic activities also influence due to availability of food for microbes in organic content rich soil. Balance use of fertilizers (RDF-recommended dose of fertilizers) enhances plant growth and development so that plant will survive easily and plants will be healthy.

Overall survival percentage during two year in table 4.21.3 showed significant result only in six month old seedling in usar and two year old seedling at rocky sites and others were non-significant. Organic fertilizers (FYM, vermicompost) also enhance plant survivability via improving soil structure, root biomass therefore metabolic activities also influence due to availability of food for microbes in organic content rich soil. Balance use of fertilizers (RDF-recommended dose of fertilizers) enhances plant growth and development so that plant will survive easily and plants will be healthy.

5.4. Soil Analysis in Rocky and Usar type soil-

pH- Soil pH is mainly affected by H^+ and Al^{+3} ions. Both these ions affect soil acidity differently. In acidic soils plant roots are thin and less in number and their growth is checked. In saline soils due to excess of OH ions development of roots is stopped, hence plants growth is reduced the suitable pH of general plants is 5.5-7.5

Soil aeration- root development is less in soils having less than 10% O₂ and is totally stopped at 5% with an increase in organic matter capillary water increase. Capillary water present in soil is essential and available plants.

Electric conductivity- With change in soil humidity EC changes by determining electric conductivity in soil: water (1:2.5) suspension by EC meter assessment of soluble salts is done.

Nitrogen- Nitrogen is essentially present in protoplasm of each cell as protein. It is also an integral part of Chlorophyll, Phosphalite, Nucleotide and Alkaloids which have great relation with vagatative life. It helps in formation of many Vitamins, hormones and enzymes, so its absence or deficiency has very bad effect on plant growth.

Phosphorus- Role of phosphorus is more important than other elements in plants growth. It occurs in each living cell. Its efficiency produces early growth in plants.

Organic Carbon- Soil fertility increases with an increase in organic carbon. For maintaining proper level of organic matter in soils organic manures should be applied in sufficient amount.

Chapter -6

SUMMARY AND CONCLUSION

The present study was conducted at Meja Tehsil, Allahabad during the month of December, 2011 to November, 2012 and December, 2012 to November, 2013 on two sites based on three tree species under three age group of seedlings within Allahabad of Uttar Pradesh under the title “**Assessment of Plant Species for Rehabilitation of wasteland in Meja Tehsil**” with the following objectives:

4. To study performance of suitable species for selected sites of Meja Tehsil.
5. To study physio-chemical nutrient status of soil before and after plantations.
6. Identification of site-specific technological treatments for afforestation programme.

5.1 Summary:

The results obtained for each parameter have been summarized as given below:

1. The increase height of six month old seedlings of *Carissa carandas* at Rocky site was recorded maximum in T₁₀ (30.00cm) (Vermicompost) with 10 days irrigation schedule followed by T₁₁ (27.21cm), T₄ (26.94cm) and T₇ (23.36cm) and minimum in treatment T₀ control (19.62cm) at Rocky sites.
2. The increase height of six month old seedlings of *Carissa carandas* at Usar site was recorded maximum in T₁₀ (23.42cm) (Vermicompost) with 10 days irrigation schedule followed by T₃ (21.73cm), T₁₁ (21.61cm) and T₄ (21.47cm) and minimum in treatment T₀ control (13.49cm) at Usar sites.
3. The increase height of one year old seedlings of *Carissa carandas* at Rocky site was recorded maximum in T₁₀ (41.06cm) (Vermicompost) with 10 days irrigation schedule followed by T₃ (39.00cm), T₁₁ (38.03cm) and T₄ (37.39cm) and minimum in treatment T₀ control (26.87cm) at Rocky sites.

4. The increase height of one year old seedlings of *Carissa carandas* at Usar site was recorded the maximum (33.94cm) were found in T₁₀ (Vermicompost) with 10 days irrigation schedule followed by T₃ (30.90cm), T₁₁ (28.30cm) and T₄ (27.81cm) and minimum in treatment T₀ control (18.58cm) at Usar sites.
5. The increase height of two year old seedlings of *Carissa carandas* at Rocky site was recorded maximum in T₁₀ (44.39) (Vermicompost) with 10 days irrigation schedule followed by T₁₁ (42.26cm), T₃ (36.12cm) and T₄ (34.75cm) and minimum (28.84cm) were found in treatment T₀ (control) at Rocky sites.
6. The increase height of two year old seedlings of *Carissa carandas* at Usar site was recorded the maximum (37.83cm) were found in T₁₀ (Vermicompost) with 10 days irrigation schedule followed by T₃ (36.12cm), T₁₁ (35.62cm) and T₄ (34.75cm) and minimum in treatment T₀ control (24.13cm) at Usar sites.
7. The increase collar diameter of six month old seedlings of *Carissa carandas* at Rocky site was recorded the maximum increase collar diameter (3.89cm) were found in T₁₀ (Vermicompost) with 10 days irrigation schedule followed by T₃(2.60cm), T₁₁(2.44cm) and T₄(2.27cm) and minimum increase collar diameter were found in treatment T₀ control (1.54cm) at Rocky sites.
8. The increase collar diameter of six month old seedlings of *Carissa carandas* at Usar site was recorded the maximum increase collar diameter were found in T₁₀ (2.43cm) (Vermicompost) with 10 days irrigation schedule followed by T₃ (2.29cm), T₁₁ (2.23cm) and T₄ (2.19cm) and minimum increase collar diameter were found in treatment T₀ control (1.24cm) at Usar sites.
9. The increase collar diameter of one year old seedlings of *Carissa carandas* at Rocky site was recorded the maximum increase collar diameter (3.58cm) were found in T₁₀ (Vermicompost) with 10 days irrigation schedule followed by T₃ (3.52cm), T₁₁ (3.40cm) and T₄ (3.32cm) and minimum increase collar diameter were found in treatment T₀ control (1.86cm) at Rocky sites.

10. The increase collar diameter of one year old seedlings of *Carissa carandas* at Usar site was recorded the maximum increase collar diameter (3.31cm) were found in T₁₀ (Vermicompost) with 10 days irrigation schedule followed by T₃ (3.25cm), T₁₁ (3.22cm) and T₄ (3.12cm) and minimum increase collar diameter (1.33cm) were found in treatment T₀ (control) at Usar sites.
11. The increase collar diameter of two year old seedlings of *Carissa carandas* at Rocky site was recorded the maximum increase collar diameter (4.43cm) were found in T₁₀ (Vermicompost) with 10 days irrigation schedule followed by T₃ (4.29cm), T₁₁ (4.23cm) and T₄ (4.05cm) and minimum increase collar diameter were found in treatment T₀ control (2.58cm) at Rocky sites.
12. The increase collar diameter of two year old seedlings of *Carissa carandas* at Usar site was recorded the maximum increase collar diameter (4.14cm) were found in T₁₀ (Vermicompost) with 10 days irrigation schedule followed by T₃ (3.91cm), T₁₁ (3.73cm) and T₄ (3.45cm) and minimum increase collar diameter were found in treatment T₀ control (2.22cm) at Usar sites.
13. The survival percentage of six month and two year old seedlings of *Carissa carandas* at Rocky site was recorded the significant maximum survival percentage i.e. 100% was found in T₁, T₂, T₃, T₄, T₅, T₇, T₈, T₉, T₁₀, T₁₁, T₁₂ and followed by T₆ with 66.67 percent and minimum survival percentage were found in treatment T₀ control (33.33%) at Rocky sites.
14. The survival percentage of six month, one year and two year old seedlings of *Carissa carandas* at Rocky site was recorded the non-significant maximum survival percentage i.e. 100% was found in T₁, T₂, T₃, T₄, T₅, T₇, T₈, T₁₀, T₁₁, T₁₂ and followed by T₆, T₉ with 66.67 percent and minimum survival percentage were found in treatment T₀ control (33.33%) at Usar sites.
15. The survival percentage of one year old seedlings of *Carissa carandas* at Rocky was recorded the non-significant maximum survival percentage i.e. 100% was found in T₁, T₂, T₃, T₄, T₅, T₆, T₇, T₈, T₉, T₁₀, T₁₁, T₁₂ and minimum survival percentage were found in treatment T₀ control (33.33%) at Rocky sites and in two year old seedlings at Rocky site minimum was found 33.33%.

16. The increase height of six month old seedlings of *Pongamia pinnata* at Rocky site was recorded maximum in T₁₀ (117.10cm) (Vermicompost) 10 days irrigation schedule followed by T₃ (107.64cm), T₁₁ (105.16cm) and T₄ (99.63cm), minimum in treatment T₀ control (62.35cm) at Rocky sites.
17. The increase height of six month old seedlings of *Pongamia pinnata* at Usar site was recorded the maximum (108.34cm) were found in T₁₀ (Vermicompost) 10 days irrigation schedule followed by T₃ (94.35cm), T₁₁ (90.45cm) and T₄ (87.11cm), minimum in treatment T₀ control (46.55cm) at Usar sites.
18. The increase height of one year old seedlings of *Pongamia pinnata* at Rocky site was recorded maximum in T₁₀ (170.60cm) (Vermicompost) 10 days irrigation schedule followed by T₃ (159.32cm), T₁₁ (156.04cm) and T₄ (152.04cm), and minimum in treatment T₀ control (76.66cm) at Rocky sites.
19. The increase height of one year old seedlings of *Pongamia pinnata* at Usar site was recorded the maximum (139.78cm) were found in T₁₀ (Vermicompost) 10 days irrigation schedule followed by T₃ (138.67cm), T₁₁ (123.05cm) and T₄ (119.47cm), and minimum in treatment T₀ control (61.09cm) at Usar sites.
20. The increase height of two year old seedlings of *Pongamia pinnata* at Rocky site was recorded maximum in T₁₀ (139.78cm) (Vermicompost) 10 days irrigation schedule followed by T₃ (184.69cm), T₁₁ (184.57cm) and T₄ (172.70cm), and minimum (61.09cm) were found in treatment T₀ (control) at Rocky sites.
21. The increase height of two year old seedlings of *Pongamia pinnata* at Usar site was recorded the maximum (193.67cm) were found in T₁₀ (Vermicompost) 10 days irrigation schedule followed by T₃ (145.65cm), T₁₁ (134.00cm) and T₄ (129.05cm), and minimum in treatment T₀ control (104.47cm) at Usar sites.
22. The increase collar diameter of six month old seedlings of *Pongamia pinnata* at Rocky site was recorded the maximum increase collar diameter were found in T₁₀ (10.79cm) (Vermicompost) with 10 days irrigation schedule followed by T₃ (10.14cm), T₁₁ (9.91cm) and T₄ (9.47cm) and minimum increase collar diameter (4.98cm) were found in treatment T₀ (control) at Rocky sites.
23. The increase collar diameter of six month old seedlings of *Pongamia pinnata* at Usar site was recorded the maximum increase collar diameter (8.02cm) were found in T₁₀ (Vermicompost)

with 10 days irrigation schedule followed by T₃ (7.42cm), T₁₁ (7.01cm) and T₄ (6.75cm) and minimum in treatment T₀ control (4.05cm) at Usar sites.

24. The increase collar diameter of one year old seedlings of *Pongamia pinnata* at Rocky site was recorded the maximum increase collar diameter were found in T₁₀ (12.71cm) (Vermicompost) with 10 days irrigation schedule followed by T₃ (11.35cm), T₁₁ (10.63cm) and T₄ (10.28cm) and minimum increase collar diameter (5.75cm) were found in treatment T₀ (control) at Rocky sites.
25. The increase collar diameter of one year old seedlings of *Pongamia pinnata* at Usar site was recorded the maximum increase collar diameter (11.88cm) were found in T₁₀ (Vermicompost) with 10 days irrigation schedule followed by T₃ (10.09cm), T₁₁ (9.16cm) and T₄ (8.62cm) and minimum increase collar diameter were found in treatment T₀ control (4.93cm) at Usar sites.
26. The increase collar diameter of two year old seedlings of *Pongamia pinnata* at Rocky site was recorded maximum in T₁₀ (17.98cm) (Vermicompost) with 10 days irrigation schedule followed by T₃ (16.95cm), T₁₁ (16.13cm) and T₄ (15.86cm) and minimum in treatment T₀ control (9.69cm) at Rocky sites.
27. The increase collar diameter of two year old seedlings of *Pongamia pinnata* at Usar site was recorded the maximum increase collar diameter (16.06cm) were found in T₁₀ (Vermicompost) with 10 days irrigation schedule followed by T₃ (14.65cm), T₁₁ (13.69cm) and T₄ (13.50cm) and minimum increase collar diameter were found in treatment T₀ control (7.09cm) at Usar sites.
28. The survival percentage of seedlings of *Pongamia* was recorded the non significant maximum survival percentage i.e. 100% was found in T₁, T₂, T₃, T₄, T₅, T₇, T₈, T₁₀, T₁₁ and except T₆, and T₁₂ six month at Rocky and T₁₂ six month Usar and one year Rocky. This followed T₆ six month Rocky, T₁₂ six month Usar and Rocky and one year Rocky and T₉ with 66.67 percent except and treatment T₀ (control) which shows (33.33%) minimum survival percentage.
29. The increase height of six month old seedlings of *Emblia officinalis* at Rocky site was recorded maximum in T₁₀ (68.30cm) (Vermicompost) with 10 days irrigation schedule followed by T₃ (64.23cm), T₁₁ (61.72cm) and T₄ (57.23cm) and minimum in treatment T₀ control (9.00cm) at Rocky sites.
30. The increase height of six month old seedlings of *Emblia officinalis* at Usar site was recorded the maximum (55.90cm) were found in T₁₀ (Vermicompost) with 10 days irrigation schedule

followed by T₃ (51.25cm), T₁₁ (48.96cm) and T₄ (45.34cm) and minimum in treatment T₀ control (10.78cm) at Usar sites.

31. The increase height of one year old seedlings of *Emblica officinalis* at Rocky site was recorded maximum in T₁₀ (100.22cm) (Vermicompost) with 10 days irrigation schedule followed by T₃ (93.13cm), T₁₁ (89.31cm) and T₄ (85.42cm) and minimum in treatment T₀ control (22.03cm) at Rocky sites.
32. The increase height of one year old seedlings of *Emblica officinalis* at Usar site was recorded the maximum (75.12cm) were found in T₁₀ (Vermicompost) with 10 days irrigation schedule followed by T₃ (70.66cm), T₁₁ (68.07cm) and T₄ (63.17cm) and minimum in treatment T₀ control (11.65cm) at Usar sites.
33. The increase height of two year old seedlings of *Emblica officinalis* at Rocky site was recorded maximum in T₁₀ (111.21cm) (Vermicompost) with 10 days irrigation schedule followed by T₃ (106.09cm), T₁₁ (102.76cm) and T₄(96.85cm) and minimum in treatment T₀ control (11.85cm) at Rocky sites.
34. The increase height of two year old seedlings of *Emblica officinalis* at Usar site was recorded maximum in T₁₀ (84.63cm) (Vermicompost) with 10 days irrigation schedule followed by T₃ (77.79cm), T₁₁ (74.26cm) and T₄ (69.33cm) and minimum in treatment T₀ control (16.78cm) at Usar sites.
35. The increase collar diameter of six month old seedlings of *Emblica officinalis* at Rocky site was recorded the maximum increase collar diameter (9.56cm) were found in T₁₀ (VC 10 days irrigation schedule) and followed by T₃ (7.87cm), T₁₁ (7.74cm) and T₄ (6.82cm) and minimum increase collar diameter (2.16cm) were found in treatment T₀ (control) at Rocky sites.
36. The increase collar diameter of six month old seedlings of *Emblica officinalis* at Usar site was recorded the maximum increase collar diameter (7.79cm) were found in T₁₀ (Vermicompost) with 10 days irrigation schedule followed by T₃ (6.87cm), T₁₁ (6.23cm) and T₄ 5.70cm) and minimum increase collar diameter (2.11cm) were found in treatment T₀ (control) at Usar sites
37. The increase collar diameter of one year old seedlings of *Emblica officinalis* at Rocky site was recorded maximum in T₁₀ (10.70cm) (Vermicompost) with 10 days irrigation schedule followed by T₃ (9.66cm), T₁₁ (9.10cm) and T₄ (8.50cm) and minimum increase collar diameter were found in treatment T₀ control (3.05cm) at Rocky sites.

38. The increase collar diameter of one year old seedlings of *Emblica officinalis* at Usar site was recorded the maximum increase collar diameter (10.44cm) were found in T₁₀ (Vermicompost) with 10 days irrigation schedule followed by T₃ (8.88cm), T₁₁ (8.33cm) and T₄ (7.42cm) and minimum in treatment T₀ control (2.97cm) at Usar sites.
39. The increase collar diameter of two year old seedlings of *Emblica officinalis* at Rocky site was recorded the maximum increase collar diameter were found in T₁₀ (11.43cm) (Vermicompost) with 10 days irrigation schedule followed by T₃ (10.81cm), T₁₁ (9.90cm) and T₄ (8.83cm) and minimum in treatment T₀ control (2.22cm) at Rocky sites.
40. The increase collar diameter of two year old seedlings of *Emblica officinalis* at Usar site was recorded the maximum (10.13cm) were found in T₁₀ (VC 10 days irrigation schedule) and followed by T₃ (9.40cm), T₁₁ (9.19cm) and T₄ (7.87cm) and minimum increase collar diameter were found in treatment T₀ control (2.56cm) at Usar sites
41. The survival percent of seedlings of *Emblica officinalis* was recorded the non significant maximum survival percentage i.e. 100% was found in T₃ and T₁₀ in both sites. This followed in six month old seedling T₁, T₂, T₄, T₅, T₇, T₈, T₁₁, T₁₂ at Rocky and T₂ in Usar sites, in one year old seedling T₆, T₉ at Rocky and T₀, T₂, T₅, T₆, T₇, T₈, T₉ and T₁₂, in two year old seedling T₉ in Rocky and T₆, T₉ in Usar with 66.67 percent and treatment shows minimum survival percentage 33.33 in six month old seedling T₀, T₆, T₉ at Rocky and T₀, T₆, T₇, T₈, T₉, T₁₂ in Usar sites, in one year old seedling T₀ at Rocky, in two year old seedling.

CONCLUSION

From the present investigation it is concluded that,

1. *Pongamia pinnata* found best for plantation on both type of soil than other two tree species *Emblica officinalis* and *Carisca carandas*.
2. Under site specific treatment T₁₀ (vermicompost with 10 days of irrigation schedule) were found best treatment as compared to other treatments.
3. Overall it is also observed that treatment T₁₀ (vermicompost with 10 days of irrigation schedule) showed the maximum physio-chemical nutrient status, survival percentage growth performance for both the sites (Rocky and Usar) for all the tree species, but survival percentage is best in Usar sites of *Emblica officinalis*, followed by T₃, T₁₁ and minimum was found in T₀.

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4.19.1.	Increase in plant height (cm) of Karondha					6 months	Rocky Site	2011-2013	TOTAL
	Source of variation	d. f.	S.S.	M.S.S.	F. Cal.	F. Tab. 5%	Result	S. Ed. (±)	C.D. at 5%
	Due to Replication	2	34.89	17.45	0.78	3.40	NS	-	-
	Due to Treatment	12	1402.15	116.85	5.25	2.18	S	3.85	7.95
	Due to Error	24	533.96	22.25	-	-	-	-	-
	TOTAL	38	1971.00	-	-	-	-	-	-

4.19.1.	Increase in plant height (cm) of Karondha					6 months	Usar Site	2011-2013	TOTAL
	Source of variation	d. f.	S.S.	M.S.S.	F. Cal.	F. Tab. 5%	Result	S. Ed. (±)	C.D. at 5%
	Due to Replication	2	46.28	23.14	1.32	3.40	NS	-	-
	Due to Treatment	12	1205.77	100.48	5.74	2.18	S	3.42	7.05
	Due to Error	24	420.39	17.52	-	-	-	-	-
	TOTAL	38	1672.45	-	-	-	-	-	-

4.19.1.	Increase in plant height (cm) of Karondha					1 yr seedling	Rocky Site	2011-2013	TOTAL
	Source of variation	d. f.	S.S.	M.S.S.	F. Cal.	F. Tab. 5%	Result	S. Ed. (±)	C.D. at 5%
	Due to Replication	2	99.41	49.71	2.10	3.40	NS	-	-
	Due to Treatment	12	1301.59	108.47	4.59	2.18	S	3.97	8.19
	Due to Error	24	567.07	23.63	-	-	-	-	-
	TOTAL	38	1968.07	-	-	-	-	-	-

4.19.1.	Increase in plant height (cm) of Karondha					1 yr seedling	Usar Site	2011-2013	TOTAL
	Source of variation	d. f.	S.S.	M.S.S.	F. Cal.	F. Tab. 5%	Result	S. Ed. (±)	C.D. at 5%
	Due to Replication	2	30.97	15.49	0.63	3.40	NS	-	-
	Due to Treatment	12	1608.15	134.01	5.45	2.18	S	4.05	8.36
	Due to Error	24	589.91	24.58	-	-	-	-	-
	TOTAL	38	2229.03	-	-	-	-	-	-

4.19.1.	Increase in plant height (cm) of Karondha					2 yr seedling	Rocky Site	2011-2013	TOTAL
	Source of variation	d. f.	S.S.	M.S.S.	F. Cal.	F. Tab. 5%	Result	S. Ed. (±)	C.D. at 5%
	Due to Replication	2	154.39	77.19	1.88	3.40	NS	-	-
	Due to Treatment	12	3636.32	303.03	7.39	2.18	S	5.23	10.79
	Due to Error	24	984.08	41.00	-	-	-	-	-
	TOTAL	38	4774.79	-	-	-	-	-	-

4.19.1.	Increase in plant height (cm) of Karondha					2 yr seedling	Usar Site	2011-2013	TOTAL
	Source of variation	d. f.	S.S.	M.S.S.	F. Cal.	F. Tab. 5%	Result	S. Ed. (±)	C.D. at 5%
	Due to Replication	2	115.71	57.86	1.09	3.40	NS	-	-
	Due to Treatment	12	2820.58	235.05	4.44	2.18	S	5.94	12.26

Due to Error	24	1270.41	52.93	-	-	-	-	-
TOTAL	38	4206.71	-	-	-	-	-	-

4.19.2.	Increase in collar diameter (cm) of Karondha					6 months	Rocky Site	2011-2013	TOTAL
	Source of variation	d. f.	S.S.	M.S.S.	F. Cal.	F. Tab. 5%	Result	S. Ed. (±)	C.D. at 5%
	Due to Replication	2	2.05	1.02	11.80	3.40	S	-	-
	Due to Treatment	12	21.74	1.81	20.89	2.18	S	0.24	0.50
	Due to Error	24	2.08	0.09	-	-	-	-	-
	TOTAL	38	25.86	-	-	-	-	-	-

4.19.2.	Increase in collar diameter (cm) of Karondha					6 months	Usar Site	2011-2013	TOTAL
	Source of variation	d. f.	S.S.	M.S.S.	F. Cal.	F. Tab. 5%	Result	S. Ed. (±)	C.D. at 5%
	Due to Replication	2	2.12	1.06	12.65	3.40	S	-	-
	Due to Treatment	12	13.77	1.15	13.71	2.18	S	0.24	0.49
	Due to Error	24	2.01	0.08	-	-	-	-	-
	TOTAL	38	17.90	-	-	-	-	-	-

4.19.2.	Increase in collar diameter (cm) of Karondha					1 yr seedling	Rocky Site	2011-2013	TOTAL
	Source of variation	d. f.	S.S.	M.S.S.	F. Cal.	F. Tab. 5%	Result	S. Ed. (±)	C.D. at 5%

Due to Replication	2	2.55	1.27	19.08	3.40	S	-	-
Due to Treatment	12	17.30	1.44	21.60	2.18	S	0.21	0.44
Due to Error	24	1.60	0.07	-	-	-	-	-
TOTAL	38	21.44	-	-	-	-	-	-

4.19.2.	Increase in collar diameter (cm) of Karondha				1 yr seedling	Usar Site	2011-2013	TOTAL	
	Source of variation	d. f.	S.S.	M.S.S.	F. Cal.	F. Tab. 5%	Result	S. Ed. (±)	C.D. at 5%
	Due to Replication	2	2.54	1.27	15.07	3.40	S	-	-
	Due to Treatment	12	26.21	2.18	25.88	2.18	S	0.24	0.49
	Due to Error	24	2.03	0.08	-	-	-	-	-
	TOTAL	38	30.78	-	-	-	-	-	-

4.19.2.	Increase in collar diameter (cm) of Karondha					2 yr seedling	Rocky Site	2011-2013	TOTAL
	Source of variation	d. f.	S.S.	M.S.S.	F. Cal.	F. Tab. 5%	Result	S. Ed. (±)	C.D. at 5%
	Due to Replication	2	5.82	2.91	15.50	3.40	S	-	-
	Due to Treatment	12	34.33	2.86	15.25	2.18	S	0.35	0.73
	Due to Error	24	4.50	0.19	-	-	-	-	-
	TOTAL	38	44.65	-	-	-	-	-	-

4.19.2.	Increase in collar diameter (cm) of Karondha					2 yr seedling	Usar Site	2011-2013	TOTAL
	Source of variation	d. f.	S.S.	M.S.S.	F. Cal.	F. Tab. 5%	Result	S. Ed. (±)	C.D. at 5%
	Due to Replication	2	5.50	2.75	10.02	3.40	S	-	-
	Due to Treatment	12	35.26	2.94	10.71	2.18	S	0.43	0.88
	Due to Error	24	6.58	0.27	-	-	-	-	-
	TOTAL	38	47.34	-	-	-	-	-	-

4.19.3.	Survival percentage of Karondha					6 months	Rocky Site	2011-2013	TOTAL
	Source of variation	d. f.	S.S.	M.S.S.	F. Cal.	F. Tab. 5%	Result	S. Ed. (±)	C.D. at 5%
	Due to Replication	2	1538.46	769.23	1.57	3.40	NS	-	-
	Due to Treatment	12	14358.97	1196.58	2.43	2.18	S	18.10	37.36
	Due to Error	24	11794.87	491.45	-	-	-	-	-
	TOTAL	38	27692.31	-	-	-	-	-	-

4.19.3.	Survival percentage of Karondha					6 months	Usar Site	2011-2013	TOTAL
	Source of variation	d. f.	S.S.	M.S.S.	F. Cal.	F. Tab. 5%	Result	S. Ed. (±)	C.D. at 5%
	Due to Replication	2	3589.74	1794.87	2.62	3.40	NS	-	-
	Due to	12	15897.44	1324.79	1.94	2.18	NS	-	-

Treatment								
Due to Error	24	16410.26	683.76	-	-	-	-	-
TOTAL	38	35897.44	-	-	-	-	-	-

4.19.3.	Survival percentage of Karondha					1 yr seedling	Rocky Site	2011-2013	TOTAL
	Source of variation	d. f.	S.S.	M.S.S.	F. Cal.	F. Tab. 5%	Result	S. Ed. (±)	C.D. at 5%
	Due to Replication	2	512.82	256.41	1.00	3.40	NS	-	-
	Due to Treatment	12	3076.92	256.41	1.00	2.18	NS	-	-
	Due to Error	24	6153.85	256.41	-	-	-	-	-
	TOTAL	38	9743.59	-	-	-	-	-	-

4.19.3.	Survival percentage of Karondha					1 yr seedling	Usar Site	2011-2013	TOTAL
	Source of variation	d. f.	S.S.	M.S.S.	F. Cal.	F. Tab. 5%	Result	S. Ed. (±)	C.D. at 5%
	Due to Replication	2	3589.74	1794.87	2.62	3.40	NS	-	-
	Due to Treatment	12	15897.44	1324.79	1.94	2.18	NS	-	-
	Due to Error	24	16410.26	683.76	-	-	-	-	-
	TOTAL	38	35897.44	-	-	-	-	-	-

4.19.3.	Survival percentage of Karondha					2 yr seedling	Rocky Site	2011-2013	TOTAL
	Source of variation	d. f.	S.S.	M.S.S.	F. Cal.	F. Tab. 5%	Result	S. Ed. (±)	C.D. at 5%

Due to Replication	2	1538.46	769.23	1.57	3.40	NS	-	-
Due to Treatment	12	14358.97	1196.58	2.43	2.18	S	18.10	37.36
Due to Error	24	11794.87	491.45	-	-	-	-	-
TOTAL	38	27692.31	-	-	-	-	-	-

4.19.3.	Survival percentage of Karondha					2 yr seedling	Usar Site	2011-2013	TOTAL
	Source of variation	d. f.	S.S.	M.S.S.	F. Cal.	F. Tab. 5%	Result	S. Ed. (±)	C.D. at 5%
	Due to Replication	2	3589.74	1794.87	2.62	3.40	NS	-	-
	Due to Treatment	12	15897.44	1324.79	1.94	2.18	NS	-	-
	Due to Error	24	16410.26	683.76	-	-	-	-	-
	TOTAL	38	35897.44	-	-	-	-	-	-

4.20.1.	Increase in plant height (cm) of Karanj					6 months	Rocky Site	2011-2013	TOTAL
	Source of variation	d. f.	S.S.	M.S.S.	F. Cal.	F. Tab. 5%	Result	S. Ed. (±)	C.D. at 5%
	Due to Replication	2	1431.84	715.92	5.18	3.40	S	-	-
	Due to Treatment	12	22054.48	1837.87	13.31	2.18	S	9.60	19.81
	Due to Error	24	3315.19	138.13	-	-	-	-	-
	TOTAL	38	26801.51	-	-	-	-	-	-

4.20.1.	Increase in plant height (cm) of Karanj					6 months	Usar Site	2011-2013	TOTAL
	Source of variation	d. f.	S.S.	M.S.S.	F. Cal.	F. Tab. 5%	Result	S. Ed. (±)	C.D. at 5%
	Due to Replication	2	1034.83	517.42	3.17	3.40	NS	-	-
	Due to Treatment	12	22777.03	1898.09	11.62	2.18	S	10.43	21.53
	Due to Error	24	3918.86	163.29	-	-	-	-	-
	TOTAL	38	27730.72	-	-	-	-	-	-

4.20.1.	Increase in plant height (cm) of Karanj					1 yr seedling	Rocky Site	2011-2013	TOTAL
	Source of variation	d. f.	S.S.	M.S.S.	F. Cal.	F. Tab. 5%	Result	S. Ed. (±)	C.D. at 5%
	Due to Replication	2	2191.26	1095.63	4.07	3.40	S	-	-
	Due to Treatment	12	64804.80	5400.40	20.05	2.18	S	13.40	27.66
	Due to Error	24	6462.98	269.29	-	-	-	-	-
	TOTAL	38	73459.03	-	-	-	-	-	-

4.20.1.	Increase in plant height (cm) of Karanj					1 yr seedling	Usar Site	2011-2013	TOTAL
	Source of variation	d. f.	S.S.	M.S.S.	F. Cal.	F. Tab. 5%	Result	S. Ed. (±)	C.D. at 5%
	Due to Replication	2	1008.35	504.18	4.56	3.40	S	-	-
	Due to Treatment	12	37319.54	3109.96	28.15	2.18	S	8.58	17.71

Due to Error	24	2651.63	110.48	-	-	-	-	-
TOTAL	38	40979.53	-	-	-	-	-	-

4.20.1.	Increase in plant height (cm) of Karanj					2 yr seedling	Rocky Site	2011-2013	TOTAL
	Source of variation	d. f.	S.S.	M.S.S.	F. Cal.	F. Tab. 5%	Result	S. Ed. (±)	C.D. at 5%
	Due to Replication	2	1534.02	767.01	2.45	3.40	NS	-	-
	Due to Treatment	12	62770.97	5230.91	16.74	2.18	S	14.43	29.79
	Due to Error	24	7500.92	312.54	-	-	-	-	-
	TOTAL	38	71805.91	-	-	-	-	-	-

4.20.1.	Increase in plant height (cm) of Karanj					2 yr seedling	Usar Site	2011-2013	TOTAL
	Source of variation	d. f.	S.S.	M.S.S.	F. Cal.	F. Tab. 5%	Result	S. Ed. (±)	C.D. at 5%
	Due to Replication	2	3477.63	1738.81	2.75	3.40	NS	-	-
	Due to Treatment	12	60202.27	5016.86	7.94	2.18	S	20.52	42.36
	Due to Error	24	15163.80	631.83	-	-	-	-	-
	TOTAL	38	78843.70	-	-	-	-	-	-

4.20.2.	Increase in collar diameter (cm) of Karanj					6 months	Rocky Site	2011-2013	TOTAL
	Source of variation	d. f.	S.S.	M.S.S.	F. Cal.	F. Tab. 5%	Result	S. Ed. (±)	C.D. at 5%

Due to Replication	2	48.83	24.41	12.90	3.40	S	-	-
Due to Treatment	12	311.46	25.95	13.71	2.18	S	1.12	2.32
Due to Error	24	45.44	1.89	-	-	-	-	-
TOTAL	38	405.72	-	-	-	-	-	-

4.20.2.	Increase in collar diameter (cm) of Karanj					6 months	Usar Site	2011-2013	TOTAL
	Source of variation	d. f.	S.S.	M.S.S.	F. Cal.	F. Tab. 5%	Result	S. Ed. (±)	C.D. at 5%
	Due to Replication	2	24.37	12.19	10.34	3.40	S	-	-
	Due to Treatment	12	119.00	9.92	8.41	2.18	S	0.89	1.83
	Due to Error	24	28.29	1.18	-	-	-	-	-
	TOTAL	38	171.66	-	-	-	-	-	-

4.20.2.	Increase in collar diameter (cm) of Karanj					1 yr seedling	Rocky Site	2011-2013	TOTAL
	Source of variation	d. f.	S.S.	M.S.S.	F. Cal.	F. Tab. 5%	Result	S. Ed. (±)	C.D. at 5%
	Due to Replication	2	5.01	2.51	1.15	3.40	NS	-	-
	Due to Treatment	12	314.10	26.18	12.05	2.18	S	1.20	2.48
	Due to Error	24	52.11	2.17	-	-	-	-	-
	TOTAL	38	371.23	-	-	-	-	-	-

4.20.2.	Increase in collar diameter (cm) of Karanj				1 yr	Usar Site	2011-	TOTAL
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Source of variation	d. f.	S.S.	M.S.S.	F. Cal.	seedling	Result	2013	C.D. at 5%
					F. Tab. 5%		S. Ed. (±)	
Due to Replication	2	8.22	4.11	3.31	3.40	NS	-	-
Due to Treatment	12	229.96	19.16	15.41	2.18	S	0.91	1.88
Due to Error	24	29.85	1.24	-	-	-	-	-
TOTAL	38	268.03	-	-	-	-	-	-

4.20.2.	Increase in collar diameter (cm) of Karanj				2 yr seedling	Rocky Site	2011-2013	TOTAL
					F. Tab. 5%	Result	S. Ed. (±)	C.D. at 5%
	Source of variation	d. f.	S.S.	M.S.S.	F. Cal.			
	Due to Replication	2	24.56	12.28	5.37	3.40	S	-
	Due to Treatment	12	493.93	41.16	18.01	2.18	S	1.23
	Due to Error	24	54.85	2.29	-	-	-	-
	TOTAL	38	573.34	-	-	-	-	-

4.20.2.	Increase in collar diameter (cm) of Karanj				2 yr seedling	Usar Site	2011-2013	TOTAL
					F. Tab. 5%	Result	S. Ed. (±)	C.D. at 5%
	Source of variation	d. f.	S.S.	M.S.S.	F. Cal.			
	Due to Replication	2	18.06	9.03	1.20	3.40	NS	-
	Due to Treatment	12	599.67	49.97	6.63	2.18	S	2.24
	Due to Error	24	180.86	7.54	-	-	-	-
	TOTAL	38	798.59	-	-	-	-	-

4.20.3.	Survival percentage of Karanj					6 months	Rocky Site	2011-2013	TOTAL
	Source of variation	d. f.	S.S.	M.S.S.	F. Cal.	F. Tab. 5%	Result	S. Ed. (±)	C.D. at 5%
	Due to Replication	2	3589.74	1794.87	1.87	3.40	NS	-	-
	Due to Treatment	12	16923.08	1410.26	1.47	2.18	NS	-	-
	Due to Error	24	23076.92	961.54	-	-	-	-	-
	TOTAL	38	43589.74	-	-	-	-	-	-

4.20.3.	Survival percentage of Karanj					6 months	Usar Site	2011-2013	TOTAL
	Source of variation	d. f.	S.S.	M.S.S.	F. Cal.	F. Tab. 5%	Result	S. Ed. (±)	C.D. at 5%
	Due to Replication	2	2051.28	1025.64	1.37	3.40	NS	-	-
	Due to Treatment	12	15897.44	1324.79	1.77	2.18	NS	-	-
	Due to Error	24	17948.72	747.86	-	-	-	-	-
	TOTAL	38	35897.44	-	-	-	-	-	-

4.20.3.	Survival percentage of Karanj					1 yr seedling	Rocky Site	2011-13	TOTAL
	Source of variation	d. f.	S.S.	M.S.S.	F. Cal.	F. Tab. 5%	Result	S. Ed. (±)	C.D. at 5%
	Due to Replication	2	2051.28	1025.64	1.37	3.40	NS	-	-
	Due to Treatment	12	15897.44	1324.79	1.77	2.18	NS	-	-

Due to Error	24	17948.72	747.86	-	-	-	-	-
TOTAL	38	35897.44	-	-	-	-	-	-

4.20.3.	Survival percentage of Karanj					1 yr seedling	Usar Site	2011-13	TOTAL
	Source of variation	d. f.	S.S.	M.S.S.	F. Cal.	F. Tab. 5%	Result	S. Ed. (±)	C.D. at 5%
	Due to Replication	2	1538.46	769.23	1.57	3.40	NS	-	-
	Due to Treatment	12	14358.97	1196.58	2.43	2.18	S	18.10	37.36
	Due to Error	24	11794.87	491.45	-	-	-	-	-
	TOTAL	38	27692.31	-	-	-	-	-	-

4.20.3.	Survival percentage of Karanj					2 yr seedling	Rocky Site	2011-2013	TOTAL
	Source of variation	d. f.	S.S.	M.S.S.	F. Cal.	F. Tab. 5%	Result	S. Ed. (±)	C.D. at 5%
	Due to Replication	2	1538.46	769.23	1.57	3.40	NS	-	-
	Due to Treatment	12	14358.97	1196.58	2.43	2.18	S	18.10	37.36
	Due to Error	24	11794.87	491.45	-	-	-	-	-
	TOTAL	38	27692.31	-	-	-	-	-	-

4.20.3.	Survival percentage of Karanj					2 yr seedling	Usar Site	2011-2013	TOTAL
	Source of variation	d. f.	S.S.	M.S.S.	F. Cal.	F. Tab. 5%	Result	S. Ed. (±)	C.D. at 5%
	Due to	2	3589.74	1794.87	1.87	3.40	NS	-	-

Replication								
Due to Treatment	12	16923.08	1410.26	1.47	2.18	NS	-	-
Due to Error	24	23076.92	961.54	-	-	-	-	-
TOTAL	38	43589.74	-	-	-	-	-	-

4.21.1.	Increase in plant height (cm) of Aonla					6 months	Rocky Site	2011-2013	TOTAL
	Source of variation	d. f.	S.S.	M.S.S.	F. Cal.	F. Tab. 5%	Result	S. Ed. (±)	C.D. at 5%
	Due to Replication	2	1890.43	945.22	1.01	3.40	NS	-	-
	Due to Treatment	12	40275.89	3356.32	3.59	2.18	S	15.06	31.09
	Due to Error	24	22436.45	934.85	-	-	-	-	-
	TOTAL	38	64602.78	-	-	-	-	-	-

4.21.1.	Increase in plant height (cm) of Aonla					6 months	Usar Site	2011-2013	TOTAL
	Source of variation	d. f.	S.S.	M.S.S.	F. Cal.	F. Tab. 5%	Result	S. Ed. (±)	C.D. at 5%
	Due to Replication	2	2456.54	1228.27	14.84	3.40	S	-	-
	Due to Treatment	12	11564.26	963.69	11.65	2.18	S	7.43	15.33
	Due to Error	24	1985.95	82.75	-	-	-	-	-
	TOTAL	38	16006.74	-	-	-	-	-	-

4.21.1.	Increase in plant height (cm) of				1 yr	Rocky	2011-	TOTAL
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TOTAL	38	29741.09	-	-	-	-	-	-
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4.21.1.	Increase in plant height (cm) of Aonla					2 yr seedling	Usar Site	2011-2013	TOTAL
	Source of variation	d. f.	S.S.	M.S.S.	F. Cal.	F. Tab. 5%	Result	S. Ed. (±)	C.D. at 5%
	Due to Replication	2	912.07	456.03	11.54	3.40	S	-	-
	Due to Treatment	12	17672.43	1472.70	37.26	2.18	S	5.13	10.59
	Due to Error	24	948.50	39.52	-	-	-	-	-
	TOTAL	38	19533.00	-	-	-	-	-	-

4.21.2.	Increase in collar diameter (cm) of Aonla					6 months	Rocky Site	2011-2013	TOTAL
	Source of variation	d. f.	S.S.	M.S.S.	F. Cal.	F. Tab. 5%	Result	S. Ed. (±)	C.D. at 5%
	Due to Replication	2	1.15	0.58	0.11	3.40	NS	-	-
	Due to Treatment	12	200.89	16.74	3.12	2.18	S	1.89	3.91
	Due to Error	24	128.98	5.37	-	-	-	-	-
	TOTAL	38	331.02	-	-	-	-	-	-

4.21.2.	Increase in collar diameter (cm) of Aonla					6 months	Usar Site	2011-2013	TOTAL
	Source of variation	d. f.	S.S.	M.S.S.	F. Cal.	F. Tab. 5%	Result	S. Ed. (±)	C.D. at 5%
	Due to	2	14.80	7.40	4.16	3.40	S	-	-

Replication								
Due to Treatment	12	212.10	17.67	9.94	2.18	S	1.09	2.25
Due to Error	24	42.68	1.78	-	-	-	-	-
TOTAL	38	269.58	-	-	-	-	-	-

4.21.2.	Increase in collar diameter (cm) of Aonla					1 yr seedling	Rocky Site	2011-2013	TOTAL
	Source of variation	d. f.	S.S.	M.S.S.	F. Cal.	F. Tab. 5%	Result	S. Ed. (±)	C.D. at 5%
	Due to Replication	2	4.16	2.08	2.25	3.40	NS	-	-
	Due to Treatment	12	214.53	17.88	19.36	2.18	S	0.78	1.62
	Due to Error	24	22.16	0.92	-	-	-	-	-
	TOTAL	38	240.85	-	-	-	-	-	-

	Increase in collar diameter (cm) of Aonla					1 yr seedling	Usar Site	2011-2013	TOTAL
4.21.2.	Source of variation	d. f.	S.S.	M.S.S.	F. Cal.	F. Tab. 5%	Result	S. Ed. (±)	C.D. at 5%
	Due to Replication	2	4.90	2.45	0.84	3.40	NS	-	-
	Due to Treatment	12	265.55	22.13	7.58	2.18	S	1.40	2.88
	Due to Error	24	70.10	2.92	-	-	-	-	-
	TOTAL	38	340.55	-	-	-	-	-	-

4.21.2.	Increase in collar diameter (cm) of	2 yr	Rocky	2011-	TOTAL
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Aonla					seedling	Site	2013	
Source of variation	d. f.	S.S.	M.S.S.	F. Cal.	F. Tab. 5%	Result	S. Ed. (±)	C.D. at 5%
Due to Replication	2	1.38	0.69	1.63	3.40	NS	-	-
Due to Treatment	12	309.70	25.81	60.81	2.18	S	0.53	1.10
Due to Error	24	10.19	0.42	-	-	-	-	-
TOTAL	38	321.27	-	-	-	-	-	-

4.21.2.	Increase in collar diameter (cm) of Aonla					2 yr seedling	Usar Site	2011-2013	TOTAL
	Source of variation	d. f.	S.S.	M.S.S.	F. Cal.	F. Tab. 5%	Result	S. Ed. (±)	C.D. at 5%
	Due to Replication	2	7.50	3.75	5.18	3.40	S	-	-
	Due to Treatment	12	269.69	22.47	31.01	2.18	S	0.70	1.43
	Due to Error	24	17.39	0.72	-	-	-	-	-
	TOTAL	38	294.58	-	-	-	-	-	-

4.21.3.	Survival percentage of Aonla					6 months	Rocky Site	2011-2013	TOTAL
	Source of variation	d. f.	S.S.	M.S.S.	F. Cal.	F. Tab. 5%	Result	S. Ed. (±)	C.D. at 5%
	Due to Replication	2	2051.28	1025.64	0.35	3.40	NS	-	-
	Due to Treatment	12	16410.26	1367.52	0.46	2.18	NS	-	-
	Due to Error	24	71282.05	2970.09	-	-	-	-	-
	TOTAL								

TOTAL	38	89743.59	-	-	-	-	-	-
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4.21.3.	Survival percentage of Aonla					6 months	Usar Site	2011-2013	TOTAL
	Source of variation	d. f.	S.S.	M.S.S.	F. Cal.	F. Tab. 5%	Result	S. Ed. (±)	C.D. at 5%
	Due to Replication	2	22051.28	11025.64	10.75	3.40	S	-	-
	Due to Treatment	12	40000.00	3333.33	3.25	2.18	S	26.15	53.97
	Due to Error	24	24615.38	1025.64	-	-	-	-	-
	TOTAL	38	86666.67	-	-	-	-	-	-

4.21.3.	Survival percentage of Aonla					1 yr seedling	Rocky Site	2011-13	TOTAL
	Source of variation	d. f.	S.S.	M.S.S.	F. Cal.	F. Tab. 5%	Result	S. Ed. (±)	C.D. at 5%
	Due to Replication	2	3589.74	1794.87	2.62	3.40	NS	-	-
	Due to Treatment	12	15897.44	1324.79	1.94	2.18	NS	-	-
	Due to Error	24	16410.26	683.76	-	-	-	-	-
	TOTAL	38	35897.44	-	-	-	-	-	-

4.21.3.	Survival percentage of Aonla					1 yr seedling	Usar Site	2011-13	TOTAL
	Source of variation	d. f.	S.S.	M.S.S.	F. Cal.	F. Tab. 5%	Result	S. Ed. (±)	C.D. at 5%

Due to Replication	2	9743.59	4871.79	2.68	3.40	NS	-	-
Due to Treatment	12	10256.41	854.70	0.47	2.18	NS	-	-
Due to Error	24	43589.74	1816.24	-	-	-	-	-
TOTAL	38	63589.74	-	-	-	-	-	-

4.21.3. Survival percentage of Aonla					2 yr seedling	Rocky Site	2011-2013	TOTAL
Source of variation	d. f.	S.S.	M.S.S.	F. Cal.	F. Tab. 5%	Result	S. Ed. (±)	C.D. at 5%
Due to Replication	2	1538.46	769.23	1.57	3.40	NS	-	-
Due to Treatment	12	14358.97	1196.58	2.43	2.18	S	18.10	37.36
Due to Error	24	11794.87	491.45	-	-	-	-	-
TOTAL	38	27692.31	-	-	-	-	-	-

4.21.3. Survival percentage of Aonla					2 yr seedling	Usar Site	2011-2013	TOTAL
Source of variation	d. f.	S.S.	M.S.S.	F. Cal.	F. Tab. 5%	Result	S. Ed. (±)	C.D. at 5%
Due to Replication	2	3589.74	1794.87	2.62	3.40	NS	-	-
Due to Treatment	12	15897.44	1324.79	1.94	2.18	NS	-	-
Due to Error	24	16410.26	683.76	-	-	-	-	-
TOTAL	38	35897.44	-	-	-	-	-	-

