

**Effect of panchagavya and vermiwash on vegetative growth,
yield and quality of Gladiolus (*Gladiolus hybridus* Hort.) cv.**

Gunjan

ग्लेडियोलस (*ग्लेडियोलस हाइब्रीडस* होर्ट.) किस्म गुंजन की वानस्पतिक बढ़वार, उपज
एवं गुणवत्ता पर पंचगव्य और वर्मीवॉश का प्रभाव

Samraj Chauhan

Thesis

Master of Science in Horticulture

(Floriculture and Landscaping)



2019

**Department of Floriculture and Landscaping
College of Horticulture and Forestry, Jhalrapatan City,
Jhalawar – 326 023 (Raj.)
Agriculture University, Kota**

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Thesis

Submitted to the

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The Degree of

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(Floriculture and Landscaping)



By

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2019

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ACRONYMS

%	:	Per cent
/	:	Per
@	:	At the rate of
⁰ C	:	Degree celcius
C. D.	:	Critical difference
cm	:	Centimeter
cv.	:	Cultivar
D.F.	:	Degree of freedom
DAS	:	Days after sowing
<i>et al.</i>	:	(<i>et alia</i>), and others
etc	:	(<i>et crtera</i>), and other things
Fig.	:	Figure
g	:	Gram
ha.	:	Hectare
<i>i.e.</i>	:	That is
IU	:	International Unit
kg	:	Kilogram
m	:	meter
mm	:	millimeter
MT	:	million tonnes
M.S.S.	:	Mean sum of square
Max.	:	Maximum
mg	:	Milligram
Min.	:	Minimum
No.	:	Number
NS	:	Non-significant
PG	:	Panchagavya
S.S.	:	Sum of Square
SEm	:	Standard error of mean
TSS	:	Total soluble solids
Q	:	Quintal

<i>viz.</i>	:	(<i>Videlicet</i>), namely
VW	:	Vermiwash
°,'"	:	Degree, minute, second (in ref. to latitude and longitude)

CHAPTER -1

INTRODUCTION

The beauty of flowers has attracted attention of mankind from very beginning of the civilization. In an ancient and religious country like India. Flowers are intricately associated with almost all social celebrations and festivals in one or the other way. Flowers symbolize purity, beauty, peace, love and passion. It is a popular saying that flowers are associated with human being from birth to death. Flowers are frequently use as cut flowers for bouquets, vases and flower arrangements for interior decorations and as loose flowers for garlands, gajra, rangoli and veni making along with uses in worshipping, flower showers in receptions, wedding etc.

Attention towards floriculture and ornamental horticulture has been increasing in the modern India with the improvement in living standards. Aesthetic sense in human being led him to search for several plant species with beautiful flowers foliage and in general attractive and orchids are established commercial flowers and their production technology as become sophisticated. In the recent fast, few flowers like gaillardia, daisy, desi rose and marigold become additions to traditional Indian floriculture in limited areas, requiring increased attention for research and development in the country. It is necessary to develop adaptive technologies for such crops so that these can be cultivated commercially with higher returns per unit area. Commercial floriculture has attracted attention in India due to enormous export potential and increased domestic use of flowers in daily life with the improvement in living standards of people. It is said that, human borns with flowers, lives with flowers and finally dies with flowers. Different flowers are commonly used to convey the human feelings. Flowers commonly used are rose for love, pansies for thought, carnations (white) for women's love, daffodils for regard, amaryllis for pride, lilies for purity and stocks for luxury etc. Floriculture is a remunerative avocation for the rural people. The income received from a hectare of flowers is much more than the income from either a cereal or pulse crop, if done on scientific method and got proper market.

In India, the estimated area under flower crops is about 3.06 lakh hectares with production 23.92 lakh tonnes (Anon, 2017). The major flower growing states are

Karnataka, Tamil Nadu, Andhra Pradesh, West Bengal, Maharashtra, Rajasthan, Uttar Pradesh, Delhi and Haryana etc. The area under flower cultivation in India was 2.48 lakh hectares with production of 4.84 lakh tonnes cut flowers and 16.58 lakh tonnes of loose flowers (NHB 2015). India exported floricultural produce worth Rs. 450 crores (APEDA 2016). In the case of production also, the estimates could be at variance from the actual figures as some of the flowers like rose, gladiolus and tuberose are used with stem.

The cut flowers like gladiolus, rose, tuberose, chrysanthemum, carnation, gerbera, orchid, anthurium, lily etc. have commonly and frequently used for many purposes in both the local as well as in international market. Among them, gladiolus (*Gladiolus grandiflorus* L.) is one of the most important cut flower not only due to its different color of flowers, attractive spike, but easy cultivation and wide adaptability to varying soils and agro-climatic condition. It occupies a place of pride in Indian floriculture industry for its beauty, better keeping quality and suitable for cut flower. It is also a popular cut flower in whole world, not only for use in arrangements, but also for the individual florets that can provide attractiveness to bouquets. It has great demand in market for preparation of bouquets and beautiful floral arrangements.

Gladiolus (from Latin, the diminutive of gladius, a sword) is a genus of perennial bulbous flowering plants in the iris family (Iridaceae). Sometimes called the sword lily, the most widely used English common name for these plants is simply gladiolus (plural gladioli, gladioluses or sometimes gladiolas). Gladiolus also known as "Queen of the bulbous flowers" is one of the important ornamental flowering crops of the world. It is a popular cut flower owing to its versatile colours and varieties having larger keeping quality of flower. It has great economic value for cut flower trade and much valued by the aesthetic world for beauty and loving people because its prettiness and unparalleled elegance. They are widely used as artistic garlands, floral ornaments, bouquets etc. The long flower spikes are excellent as cut flower for table decoration when arranged in vases. Gladioli contribute the most important item for aesthetic, economic and social appeal. Florets open sequentially from the base of the rachis and extension of longevity of these florets helps in maintaining the economic value of these flowers for a longer time. The number of days a flower remains fresh in acceptable condition is the criterion for describing the keeping quality of flowers.

Gladiolus could be grown in any type of soil provided it is well drained. For good performance, it prefers a sandy loam soil, rich in organic matter having soil pH between 6 and 7.

As the post-harvest life of the flowers depends upon the pre-harvest factors also, nutrition is one of the important aspects in increasing the flower yield and quality of gladiolus spikes. After the green revolution, use of chemical fertilizers and pesticides in plants production increased which is dangerous to ecology and environment. Thus, the application of nutrients in small doses applied more frequently favors better growth and flower production. But, excessive use of chemical fertilizers and pesticides impose threat to the ecology and environment. Therefore, organic farming is one of the possible solutions for this problem (Rawat, 2002).

Panchagavya, an organic product has the potential to play the role of promoting growth and providing immunity in plant system. Panchagavya consists of eight products *viz.* cow dung, cow urine, cow milk, curd, jaggery, ghee, banana, and water. When suitably mixed and used, these have miraculous effects. Physico-chemical properties of panchagavya revealed that they possess almost all the major nutrients, micro nutrients and growth hormones (IAA & GA) required for crop growth. It contains properties like naturally occurring, beneficial, effective microorganisms, predominately lactic acid bacteria, yeast, actinomycetes and photosynthetic bacteria.

According to Somasundaram *et al.* (2004) use of Panchagavya was recommended to safe guard plants and soil microorganisms from time immemorial. Panchagavya had reverence in the scripts of Vedas and Vrukshyayurveda (Vriksha means plants and Ayurveda means health system). In Sanskrit, Panchagavya means the blend of five products obtained from cow. It is an organic growth promoter for crops. It comprises cow dung, cow urine, cow milk, cow's milk curd and ghee, suitably mixed to give beneficial growth effects on plants when sprayed on them. It is being applied as a better source of N₂.

Vermiwash is the spent wash collected at the passage of water through a column of earthworm culture. The spent wash was collected through a drainage pipe provided at the bottom of the vermicompost pit. The wash is a collection of excretory products and excess secretions of earth worms along with micronutrients from soil organic molecules (Yuvaraj, 2007).

Therefore, considering the significant role of panchagavya and vermiwash on plant life processes, the present research experiment entitled “The effect of panchagavya and vermiwash on vegetative growth, yield and quality of Gladiolus (*Gladiolus hybridus* hort.) cv.Gunjan” was planned with following objectives:

Objectives:

1. To study the effect of panchagavya and vermiwash on vegetative growth of gladiolus plant.
2. To study the effect of panchagavya and vermiwash on yield and quality of spike and corms.
3. To work out economic feasibility of treatments.

CHAPTER -2

REVIEW OF LITERATURE

The growth yield and quality of Gaillardia, besides soil and climate factors largely depend upon variety and management practices, such as time of planting, seedlings, irrigation, spacing, plant protection etc. The finding reported by various scientists in India and abroad on the topic “**Effect of panchagavya and vermiwash on vegetative growth, yield and quality of Gladiolus (*Gladiolus hybridus Hort.*) cv. Gunjan under Jhalawar condition**” and related aspects have been briefly reviewed and presented in chronological order in this chapter under following headings:

2.1.1 Effect of panchagavya on growth parameters –

Thamaraiselvi *et al.* (2002) conducted an experiment on the effect of growth regulators, calcium, boron and organics on rose and observed that Panchagavya (5%) in combination with calcium acetate gave highest bush height (93.91 cm). They also further reported increase in the number of flowering shoots with the treatment of Panchagavya 5% (37.72 and 28.79).

Jahagirdar *et al.* (2003) reported that modified Panchagavya mixture (MPG-3) gave better influence on plant height, number of leaves, maximum root length and pseudostem girth in Banana.

Djanaguiraman *et al.* (2005) conducted an experiment on effect of various bio-regulators on growth of tomato (CV-PKM-1) and observed maximum plant height by application of salicylic acid followed by Panchagavya 4% spray (78.5) and was at par with panchagavya 2% spray (78.2). They also reported that panchagavya at 4% spray gave maximum number of laterals per plant (20.1) which was at par with panchagavya 3% spray (19.3).

Bhalla *et al.* (2006) studied the effect of panchagavya on growth of gladiolus cv. Red Beauty and observed that the maximum plant height (102.8 cm.) were recorded when plants were treated with 6 per cent panchagavya.

Dhanma (2006) carnation cv. 'Sunrise' reported significant improvement in growth parameters with the use of common basal dose, biostimulants viz. Panchagavya (3%). He also registered the presence of various macro and micro nutrients in both the biostimulants. The increase in media and leaf nutrient content was also reported with use of biostimulants.

De and Girija (2006) reported that the application of biogas slurry + panchagavya significantly increased height as compared to inorganic farming methods after 60 days of sowing in black gram & green gram and other growth parameters viz., number of leaves, length and breadth of leaves, leaf area, number of branches etc., also followed the similar trend.

Sinta Issac (2007) reported that corms treated with panchagavya – (2% + manchurian mushroom tea – 2%) resulted in least number of days (30.33) required for 100 per cent highest plant height (59.5 cm) and highest number of leaves (7.12) in gladiolus.

Kumar *et al.* (2008) observed that combination of panchagavya 4% + Manchurian mushroom tea 2% recorded highest plant height (55.73cm) and highest number of leaves (6.87) per plant in gladiolus.

Naidu *et al.* (2009) reported that application of 50% RDF + 50% N through FYM + VAM and PSB @ 12.5 kg/ha + panchagavya @ 3% spray recorded significantly higher number of branches/plant as compared to RDF in chilli.

Sailaja *et al.* (2014) reported increased total microbial count and the physicochemical there is an increase in biomass (301%), shoot length (88.53 %) and root length (71.03 %) in panchagavya treated plants over control and plant growth substances present in Panchagavya treated soil help to bring rapid changes in phenotypes of plants and also improves the growth and ultimately improve the productivity of *Spinacia oleracea*.

Keisam *et al.* (2014) studied the effect of farm yard manure (FYM) on growth of gladiolus and observed that the maximum plant height (73.66 cm and 104.84 cm) at 30 and 45 DAP, respectively, number of leaves (5.60), leaf length (50.03 cm), leaf

width (8.62 cm) and minimum days taken for sixth leaf stage (37.10) were recorded when plants were treated with @ 7.5 t ha⁻¹ farm yard manure (FYM).

Suchita *et al.* (2017) conducted an experiment to find the variation in biochemical and growth parameters of *Abelmoschus esculentus* under different concentrations (Control, 1%, 3%, 5% and 7%) of panchagavya, and physico-chemical and biochemical properties were increased in 3% concentration. Since there was increase in growth parameters at low concentration of panchagavya, it is recommended that the panchagavya can be used for spray after diluted properly 3%.

2.1.2 Effect of panchagavya on flowering and yield parameters –

Thamaraiselvi *et al.* (2002) reported that treatment having 0.5% calcium acetate + panchagavya 5% was found effective in improving the floral characters. They also reported significant increase in the number of flowering shoots and earliness in flowering with the treatment of panchagavya 5% spray. Treatment consisting of calcium acetate 0.5% + Panchagavya 5% proved significant in improving all the floral characters such as flower weight (4.30 g) and (5.59 g), Flower diameter (6.78 and 5.38 cm), Pedicel length (3.37 and 3.78 cm) and Petal number (55.20 and 85.21) in rose.

Somasundaram *et al.* (2003) studied the different concentration of panchagavya (1 to 6%) and observed that the highest grain yield (17.87 q/ha) and highest test grain weight (3.99 gm.) in green gram.

Lourduraj *et al.* (2005) conducted a field experiment with yield attributes and grain yield of rice as influenced by organic farming practices and found that panchagavya spray resulted in significantly higher yield attributes, viz. productive tiller per hill (10.31), panicle length (20.02 cm), filled grains per panicle (99.04) and seed test weight (16.54 g) compared to control. They further reported significant higher (gm.) yield of 54.27 kg/ha with panchagavya spray compared to without panchagavya spray (4989 kg/ha) in rice.

Djanaguiraman *et al.* (2005) reported that panchagavya helps in improving all the yield attributes except number of flower clusters per plant and fruit clusters per plant. They reported that panchagavya 3% spray gave more numbers of fruit per plant (69.2), which was at par with panchagavya in tomato.

Patil *et al.* (2006) conducted trial on Tuberose cv. Phule Rajani and observed that, application of fortnight sprays of 4% Panchagavya +2% Manchurian mushroom tea was significantly superior in of flowers weight (147.60gm), flower stalks length (8.0 cm) and recorded longer vase life.

Bhalla *et al.* (2006) reported that largest number of florets per spike (13.53) with 4 % panchagavya, highest length of florets (10.67 cm) with 6 % manchurian mushroom tea + 6 % per cent panchagavya and maximum vase life (8.20 day) with 4 % manchurian mushroom tea in gladiolus cv. Red Beauty.

Singh *et al.* (2007) reported that plants receiving panchagavya (4%) through foliar spray significantly increased yield and quality attributes of tuberose viz., spike length (98.16 cm), lowest floret diameter (4.21 cm), number of florets/spike (65.25) and spike yield/m² (38.25 g). In postharvest studies, total number of florets (50.75), number of opened florets (45.00), lowest floret diameter (4.15 cm), water uptake (135.50 ml) and vase life (17.00 d) were also recorded in panchagavya (4%).

Gurav *et al.* (2008) reported that, the foliar sprays of 3% panchagavya +3% Manchurian tea were significantly superior in flowers per plant (35.4), lower stalk length (50.8), flower stalk diameter (6.78) and vase life (5.5days) of Gerbera.

Sendhilnathan *et al.* (2011) reported that , the foliar spray of panchagavya @ 3 percent was significantly increased the flowering parameters viz, commencement of flowering (50.97 days), length of flower bud (3.66 cm), flower bud diameter (3.58 cm), bud length without corolla (1.89 cm), Corolla tube length (1.63 cm), and flower yield characteristics viz, hundred bud weight (26.39 g), flower yield per plant (677.74 g), flower yield per plot (4066.44 g), flower yield per hectare (3.78 t/ha), and the quality characters like shelf life (34.39 hrs.) was achieved in Orchids.

Mahawer *et al.* (2010) reported that maximum duration of flowering (140.50 days), length of spike (52.83 cm), weight of spike (79.18 g), number of florets per spike (50.17), floret remain open at a time (13.99), keeping quality of cut spikes in plain water (12.95 days), number of spikes per plant (2.55) and yield of spikes per square meter (22.95) were recorded in treatment sprayed with 4% panchagavya + 4% manchurian mushroom tea in tuberose. cv. Puhle Rajani.

Vennila and Jayanthi (2010) found that application of 100% RDF + panchagavya spray @ 2% significantly increased the plant height (131.7 cm), fruit length (21.8 cm), fruit girth (4.66 cm), fruit weight (13.9 g/fruit), fruit yield (12.7 q/ha), dry matter production (5.9 g per plant) and number of branches (3.2 per plant) as compared to 100% RDF in okra.

Kumar *et al.* (2011) reported that maximum florets/spike (10.55), spike diameter (0.80 cm), rachis length (41.90 cm), corm weight (105.78 g), cormels/plant (20.85) and propagation coefficient (525.25%) was recorded with panchagavya (5%). While, maximum spike length (92.61 cm), length of first internode (5.44 cm) and corm diameter (7.79 cm) were recorded with panchagavya (10%) in gladiolus. cv. Candyman.

Sharma *et al.* (2011) found that plants grown in 6% panchagavya + 6% manchurian mushroom tea recorded maximum stem length (64.77 cm), number of flowers (6.60), flower size (4.99 cm), vase life (15.30 days) and A grade flowers based on stem strength (100%) and length (100%) in carnation. cv. Sunrise.

Jawaharlal *et al.* (2012) reported that, application of bio fertilizers along with the foliar spray of panchagavya @ 3% on African marigold significantly influenced the flower yield as well as xanthophyll content of flowers. The values recorded in this precision farming method for the various vegetative and flowering parameters during the first and second seasons respectively are number of flowers (60.26 and 62.29), individual flower weight (17.36 and 16.47 g), flower yield per plant (1.02 and 1.05 kg), flower yield per hectare (35.19 and 36.23 tones) and xanthophyll content (1.81 and 1.76 g per kg of fresh flowers).

Sushma *et al.* (2012) studied the effect of organic and inorganic fertilizers on sprouting, growth, flowering and nutrient status in heliconia (*Heliconia sp.*) cv. Golden Torch under protected cultivation with different combinations of organic and inorganic fertilizer. The treatment T₅ with *Glomus fasciculatum*, *Trichoderma harzianum* and other bio formulations viz., Panchagavya, Amrit pani, Agnihothra ash, dry mulch and 2 kg FYM/ m² recorded significantly less number of days for initiation of sprouting (60.67), 50 per cent sprouting (76.30), flower bud formation (208 days) and first flowering (217 days).

Naik *et al.* (2013) studied the different concentration of panchagavya on the growth and flowering of Cymbidium “Sleeping Nymph”. The media application of 1:30 panchagavya registered highest pseudo bulb length and girth and resulted in 31.66 and 41.3% increase over control, respectively. Furthermore, the number of spikes per plant, floret per spike, spike length and rachis length were recorded highest in the media application of panchagavya at 1:30 and resulted in 130, 55.3, 22.4 and 26.3% increase over control, respectively. Among the foliar application of panchagavya, the treatment receiving panchagavya at 1:30 (T3) performed better for growth and flowering of Cymbidium hybrid.

Harshavardhan *et al.* (2014) studied the influence of foliar sprays of panchagavya on flower quality, yield and vase life of Carnation (*Dianthus caryophyllus L.*) under Polyhouse. It was found that maximum flower stalk length (75.45 cm), flower stalk girth (5.56 mm), number of petals per flower (121.33), marketable flowers (98.14 %), number of flowers/plant (22.19) and vase life (10.17 days) were recorded in plants receiving panchagavya.

Bellubbil *et al.* (2015) studied the effect of integrated nutrient management on growth and flowering of *Gerbera jamasonii* cv. Rosalin and observed that, the six kinds of organic substrates along with inorganic fertilizers. 75% RDF+ *Glomus fasciculatum* + *Trichoderma harzianum* + Panchagavya + Amrut pani + Dry mulch + Agnihotra ash favorably influenced flower parameters like minimum number of days taken for 50 per cent flowering (139.87 days), maximum stalk length (75.45 cm), flower diameter (7.15 cm), number of flowers per plant (19.03) and (75.45 cm), flower diameter (7.15 cm), number of flowers per plant (19.03) and flower yield per m² (634.27) were found to be highest.

2.2.1 Effect of vermiwash on growth parameters –

Thangavel *et al.* (2003) showed that both vermiwash and vermicast extracts increased the growth of paddy. Maximum plant height (68.5 cm) was achieved with 100 per cent vermiwash extract.

Sivasubramanian and Ganeshkumar (2004) an experiment was conducted to impact of Vermiwash on the growth of African marigold. The results revealed that vermiwash spray enhanced the growth parameters (plant height, number of laterals, number of leaves and leaf area).

Samadhiya *et al* (2008) reported that, spraying of vermiwash on the tomato plants, showed significant growth i.e. number of leaves per plant. It can be concluded that the growth of tomato plants showed much positive results when grown in vermicompost. However the results were apparent when the plants were treated with vermiwash.

Venkataramana *et al.* (2009) studied the influence of foliar sprays of vermiwash (VW) and cow dung wash (CDW) on leaf yield and leaf attributing parameters in Mulberry and found that the leaf yield (72600 kg/ha/yr.) and yield attributing parameters such as plant height (199.50 cm), length of shoot plant⁻¹ (189 cm), number of branches plant⁻¹ (13.00), number of leaves plant⁻¹ (155), weight of leaves plant⁻¹ (1.20 kg), leaf moisture content (73 per cent) and leaf moisture retention capacity (85 per cent) were significantly higher in 200 ppm vermiwash.

Chattopadhyay (2014) reported that, application of 20% vermiwash+vermicompost and 10% vermiwash+vermicompost showed the earliest bud initiation, more number of leaves and maximum increase in plant height. The 5% vermiwash and vermicompost showed comparatively less growth of plants. However, the only vermiwash at all the experimental dilutions and also the only vermicompost treatment showed the intermediate results.

Sundararasu and Jeyasankar (2014) conducted trial to evaluate the effect of vermiwash on growth and productivity of brinjal plants. The results revealed that vermiwash spray enhanced the growth parameters (plant height and number of leaves). The foliar spray of vermiwash can be economically and environmentally suitable for the soil environment.

Kaur *et al.* (2015) studied the effect of vermiwash on the growth and development of leaves and stem of tomato plants. It can be concluded that the growth of tomato plants showed much positive results when grown in vermicompost. However the

results were apparent when the plants were treated with vermiwash. Hence, vermiwash proves to be an effective fertilizer which contributes the growth of plants when sprayed directly as well as mixed with a definite ratio of vermicompost.

Palagani and Singh (2017) reported that, application of bio fertilizers along with the foliar spray of vermiwash @ 4% significantly influenced the growth of gerbera.

Tamrakar *et al.* (2018) reported that, both the levels of cow urine and vermiwash (5% and 10%) resulted in significantly higher emergence of plants, increase plant height, more number of leaves plant⁻¹, longer and wider leaf as compared to control in gladiolus cv. Candyman.

2.2.2 Effect of vermiwash on flowering and yield parameters –

Kulkarni *et al.* (1996) observed significant increase in number of flowers per plant (45.73) in treatment combination of 75% recommended dose of fertilizer + vermicompost 5 tonnes/ha in China aster.

Vidhya and Anburani (2007) reported that among the various treatments, application of FYM @ 25 t/ha combined with 100 per cent of the RDF @ 120: 240: 240 g/plant as basal along with vermiwash @ 1:5 dilutions (T) improved the flowering and yield characters. The treatment applied with 0.4 per cent foliar spray of multiplex improved the flowering and yield characters viz., commencement of flowering, flower bud length, corolla tube length, hundred bud weight, number of flowers and yield per plant in mullai (*Jasminum auriculatum*).

Ansari (2008) studied the effect of vermicompost and vermiwash in reclaimed sodic soils on the productivity of spinach (*Spinacia oleracea*), onion (*Allium cepa*) and potato (*Solanum tuberosum*) and observed the yield of spinach was significantly higher in plots treated with vermiwash (1:5 v/v in water). The yield of onion was significantly higher in plots treated with vermiwash (1:10 v/v in water), whereas the average weight of onion bulbs was significantly greater in plots amended with vermicompost and vermiwash (1:5 v/v in water). The yield of potato and the average weight of potato tubers were significantly higher in plots treated with vermicompost.

Pathak and Kumar (2009) conducted experiment on vermiwash on the floral attributes and vase life of gladiolus. cv. White Prosperity. The floral attributes were significantly affected by the pre harvest bio fertilizer treatments as compared to the control. The fresh weight of spike (75.61g), dry weight of spike (23.11g), water up take (94.16ml), number of florets opened on 5 day (5.83), were maximum with vermiwash. Minimum days taken to spike emergence (82.46), maximum spike length (89.66cm), maximum rachis length (46.30cm), highest number of florets/spike (14.40), maximum diameter of first floret (10.99cm) and highest vase life (9.83) when plants were treated with vermiwash.

Siddappa and Hegde (2011) studied the nutritional treatments on the performance of curry leaf var. Suvasini. Foliar spray of vermiwash produced vigorous growth with significantly higher fresh leaf yield (13.07 t/ha) compared to control (11.13 t/ha). Among nutritional treatments, RDF + FYM (10.00 kg/plant) with vermiwash foliar spray at 50 per cent dilution recorded higher fresh leaf yield (17.74 t/ha) followed by FYM + RDF without vermiwash (15.79 t/ha) and FYM along with vermiwash (15.65 t/ha) compared to control (6.32 t/ha).

Anburani and Vidhyapriyadharshini (2012) carried out a field experiments to evaluate the potential of utilizing vermiwash on growth attributes of jasmine. Application of vermiwash increased the plant height, number of leaves per primary shoot and leaf area per plant. However, significantly the highest length of the primary shoot, number of secondary shoots, number of productive shoots and plant spread were recorded when vermiwash application @ 1 dilution was applied.

2.3.1 Effect of panchagavya and vermiwash on growth parameters-

Chakraborty *et al.* (2009) studied the effect of integrated nutrient management (INM practices in *Anthurium andreaenum* and observed that, the combination of common basal dose + 3% vermiwash + 3% Panchagavya + 3% Manchurian tea favorably influenced plant height (38.83 cm.), height leaf area (203.33 cm), maximum length of petiole (19.93 cm), maximum girth of petiole (1.33 cm).

Nagalakshmi *et al.* (2009) observed that, the combination of Panchagavya, Manchurian tea and Vermiwash at 3% recorded highest leaf length (38.00 cm), leaf width (17.2 cm), petiole length (49.4 cm), petiole girth (2.11 cm), number of suckers (5) and all the economic traits in anthurium.

Maheswari *et al.* (2017) studied the effects of vermiwash and panchagavya on *Dolichus lablab*. Different concentrations of vermiwash and panchagavya (5:2%, 10:3% and 15:4%) were applied to the bean plants once in every week for six weeks. The exo-morphological characters such as shoot length, internode length, diameter of the internode, number of leaves and leaf surface area were recorded prior to every treatment in all the groups. Interestingly, 10:3% vermiwash and panchagavya treated *lablab* beans showed better growth promoting effects than the other plants.

2.3.2 Effect of panchagavya and vermiwash on flowering and yield parameters-

Chakraborty *et al.* (2009) studied the effect of integrated nutrient management (INM) practices in *Anthurium andreanum* and observed that, the combination of common basal dose + 3% vermiwash + 3% Panchagavya + 3% Manchurian tea favorably influenced maximum number of spikes (7.00), largest spathe (9.57 cm × 7.47 cm), largest spadix (4.27 cm), longest flower stalk (34.50 cm), maximum girth of the stalk (1.30 cm), maximum field life (34.33 days) as well as vase life (19.74 days). In the second year of experiment, the same treatment was again found to be the best. The results proved that common basal dose + 3% vermiwash + 3% Panchagavya + 3% Manchuria tea is optimum for the growth and flowering of anthurium.

Nagalakshmi *et al.* (2009) observed that, the combination of Panchagavya, Manchurian tea and Vermiwash at 3% recorded early flowering (152.3 days) and number of spikes (9.4), spathe length (12.1 cm), spathe width (8.7 cm), spadix length (7.5 cm), stalk length (53.5cm), girth of stalk (1.9 cm), longevity of spike on plant (21.0 days), days to loss of lusture (16 days), days to spathe blueing (18 days) and days to spadix necrosis (19 days) were maximum in common basal dose + 3% vermiwash.

Rameshwar *et al.* (2012) reported that, application of vermiwash gave 65, 10, 26, and 27 % higher yields in knol-knol (153.25 q/ha), onion (184.1q/ha), French bean (14.5 q/ha seed yield) and paddy (18.4 q/ha), respectively over control. Panchagavya sprays to crop gave significantly higher yield to the extent of 177.81 q/ha in knol-knol, 168.9q/ha in onion and 18.9q/ha seed yield in garden pea, which was significantly higher than control.



CHAPTER -3

MATERIALS AND METHODS

The field experiment entitled “**Effect of panchagavya and vermiwash on vegetative growth, yield and quality of Gladiolus (*Gladiolus hybridus Hort.*) cv. Gunjan under Jhalawar condition**” was conducted at the Instructional Farm, Department of Floriculture and Landscaping, College of Horticulture and Forestry, Jhalrapatan, Jhalawar from October 2018 to May 2019. The details of the techniques followed and material used during the period of investigation are described in this chapter under following heads.

3.1 Experimental site

The experiment was carried out at Instructional Farm, Department of Floriculture and Landscaping, College of Horticulture and Forestry Jhalrapatan, Jhalawar, which is situated at 23°4' to 24°52' N latitude and 75°29' to 76°56' E longitude in South-East Rajasthan. Agro –climatically, the district falls in Zone-V known as Humid South Eastern Plains of Rajasthan.

3.2 Climate

The climate of the zone is sub-humid and sub-tropical characterized by mild winter and warm summer with relatively high humidity during the month of July to September. The region has mean annual rainfall 954.7 mm received from South-West monsoon during last week of June to September and sometimes scanty showers during winter season.

Metrological data (Table 3.1) shows that during the growing period of the crop the mean maximum and minimum temperature ranged between 45.25 and 5.66°C while the mean maximum and minimum relative humidity ranged between 91.34 and 25.75 per cent. The mean weekly meteorological data recorded during the crop growth period by the meteorological department of Jhalawar are presented in Table 3.1.

Table 3.1: Mean weekly weather data of crop growth period (October, 2018 to May, 2019)

AGRO-METEOROLOGICAL DATA

Metrological data	Temperature (°C)		Relative humidity (%)		Total rainfall of week (mm)
	Max.	Min.	Max.	Min.	
30 Sept.,- 6 Oct., 2018	31.93	20.85	81.58	45.13	0.50
7 - 13 Oct., 2018	32.76	13.02	80.42	43.78	0.00
14 – 20 Oct., 2018	31.80	12.65	81.07	44.92	0.00
21 – 27 Oct., 2018	30.50	12.40	81.15	45.85	0.00
28 Oct., – 3 Nov., 2018	31.25	13.18	80.76	45.75	0.00
4 - 10 Nov., 2018	30.76	12.20	81.00	46.71	0.00
11 - 17 Nov., 2018	31.82	14.25	80.00	46.57	0.00
18 - 24 Nov., 2018	28.26	13.99	95.00	57.29	0.00
25 Nov., - 1 Dec., 2018	27.59	12.63	84.00	55.34	0.00
2 - 8 Dec., 2018	28.60	13.33	93.00	44.57	0.00
9 - 15 Dec., 2018	24.24	6.45	89.00	43.45	0.00
16 - 22 Dec., 2018	25.41	8.27	91.00	46.29	0.00
23 - 29 Dec., 2018	22.22	9.59	81.00	45.00	0.00
30 Dec., 2018 - 5 Jan., 2019	22.43	8.65	84.65	33.00	0.00
6 - 12 Jan., 2019	21.83	4.14	81.57	61.86	0.00
13 - 19 Jan., 2019	21.73	6.76	81.70	35.00	0.07
20 - 26 Jan., 2019	23.12	9.23	78.16	34.29	0.05
27 Jan., - 2 Feb., 2019	24.77	7.60	83.97	31.86	0.00
3 - 9 Feb., 2019	23.24	8.27	75.00	30.45	0.00
10 - 16 Feb., 2019	26.75	8.45	80.00	34.29	0.00
17 - 23 Feb., 2019	30.15	9.63	83.12	43.87	0.00
24 Feb., - 2 March., 2019	36.70	12.43	82.35	39.20	0.00

3 - 9 March., 2019	38.88	10.77	80.41	34.82	0.00
10 - 16 March., 2019	39.14	11.82	75.56	30.18	0.00
17 - 23 March., 2019	34.49	12.40	72.58	30.11	0.00
24 – 30 March., 2019	32.89	17.81	80.11	45.59	0.00
31 March – 6 April., 2019	37.86	18.72	77.32	32.46	0.00
7 – 13 April., 2019	34.74	19.19	74.67	30.00	0.0
14-20 April., 2019	35.30	18.52	75.57	31.34	0.00
22-28 April., 2019	37.62	20.54	72.45	30.34	0.00
29-05 May., 2019	41.45	23.43	70.54	29.65	0.00
06-11 May., 2019	42.54	24.65	70.32	29.12	0.00

3.3 Soil of the experimental field

The experimental site had black soil of the clay loam type with adequate drainage facility. In order to assess the physico-chemical properties of the experimental soil, the soil samples were drawn randomly from different spots in the experimental area at a depth of 10-15 cm before the commencement of the experiment. A representative sample was prepared and subjected to mechanical physical and chemical analyses. The results of analysis along with methods used for determination are presented in Table 3.2.

Figure 3.1: Mean weekly weather data of crop growth period (October, 2018 to May, 2019)

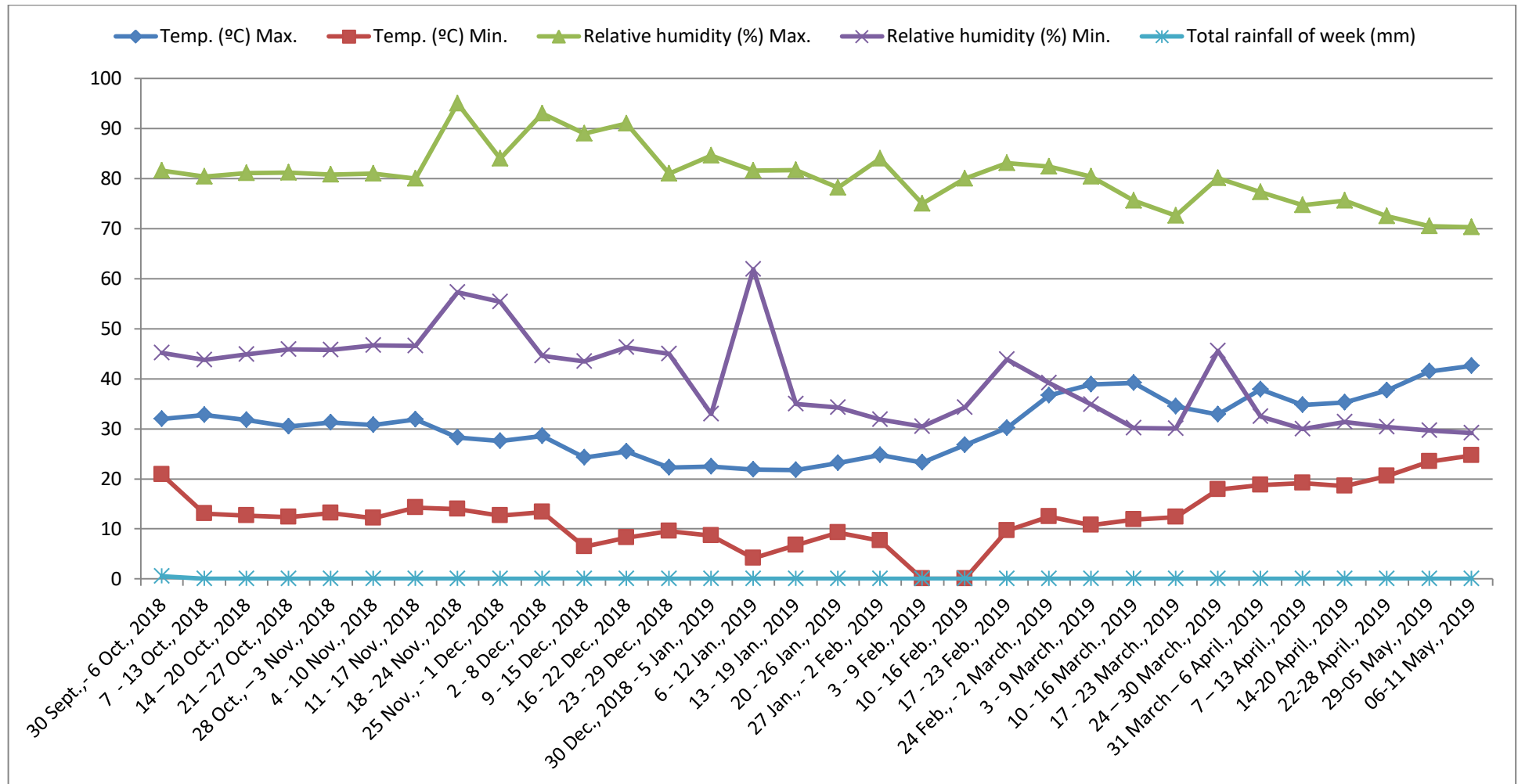


Table: 3.2 Physical-chemical properties of soil of the experimental field:

Properties		Value	Method employed
(A) Mechanical compositions			
1.	Sand (%)	23.67	Hydrometer method (Bouyoucos, 1927)
2.	Silt (%)	37.6	Hydrometer method (Bouyoucos, 1927)
3.	Clay (%)	39.8	Hydrometer method (Bouyoucos, 1927)
(B) Chemical properties			
1.	Bulk density (Mg m^{-3})	1.40	Core sampler method (Piper, 1950)
2.	Particle density	2.65	Black (1965)
3.	Porosity (%)	43.26	Black (1965)
(C) Chemical properties			
1.	Organic carbon (%)	0.56	Walkley and Black (1934)
2.	Available Nitrogen (kg/ha^{-1})	335.57	Alkali Permanganate method (Subbiah and Asija, 1965)
3.	Available phosphorus ($\text{P}_2\text{O}_5 \text{ kg ha}^{-1}$)	15.91	Olsen's method (Olsen <i>et al.</i> , 1954)
4.	Available Potassium ($\text{K}_2\text{O kg ha}^{-1}$)	216	Flame photometer method (Metson, 1956)
5.	EC (dSm^{-1} at 25°C)	0.98	Using solubridge (Jackson, 1973)
6.	pH (1 : 2, soil : water suspension)	8.0	Potentiometric method using pH meter (Jackson, 1973)

The soil of experimental site was clay loam in texture (Black cotton), low in reaction and medium in respect to nitrogen, phosphorus and potassium content.

3.4 Experimental design and layout

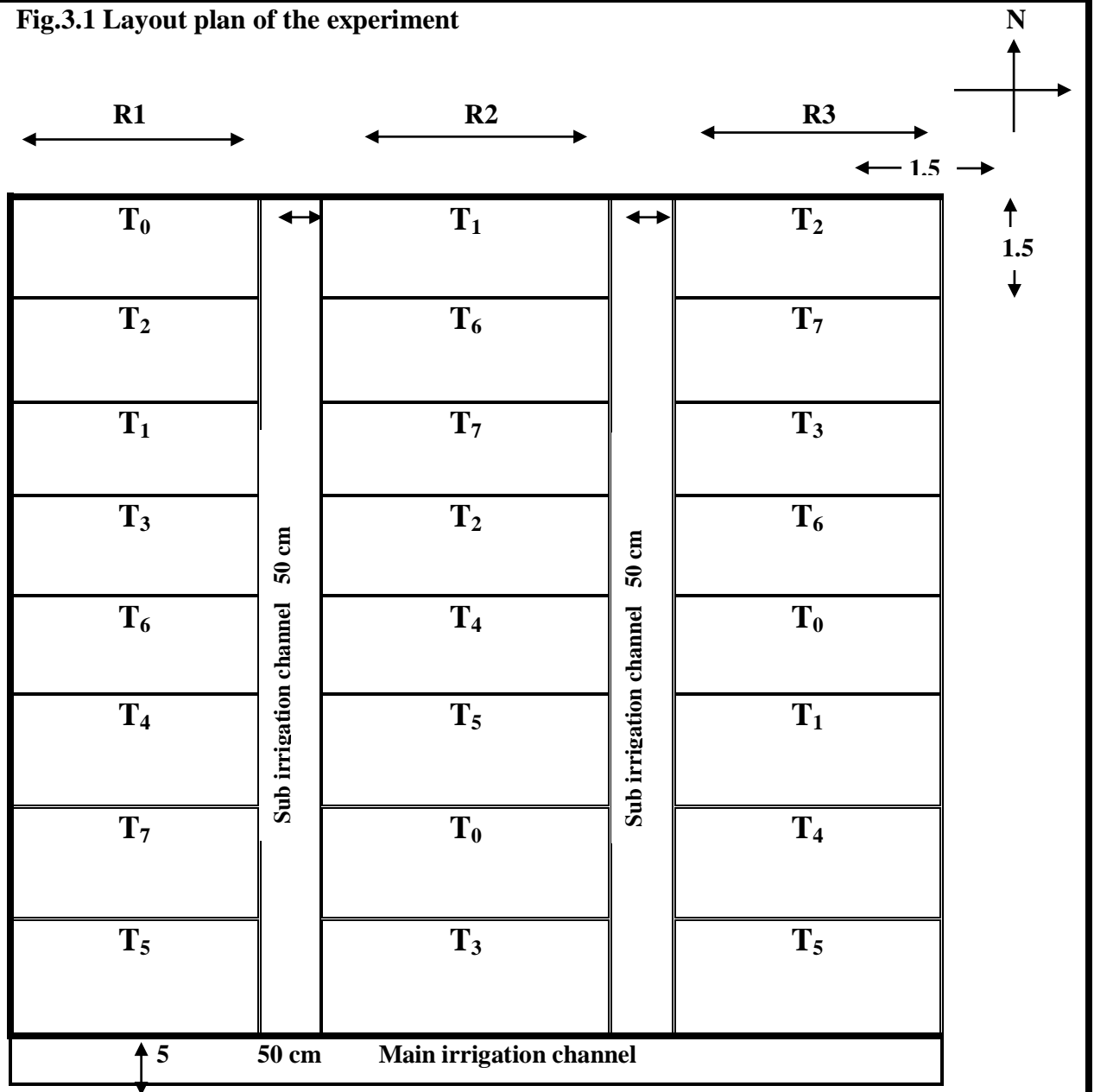
The experiment was laid out in Randomization Block Design for field experimentation. The plan of layout is depicted in Fig. 3.1 and other details are as following:

- Crop : Gladiolus (*Gladiolus hybridus*)
- Variety : Gunjan
- Number of total treatments combination : 8
- Number of total experimental units : 24
- Number of replications : 3
- Gross plot size : 3.96 m² (2.20 m x 1.80 m)
- Net plot size : 2.25 m² (1.5 m x 1.50 m)
- Spacing : 40 × 30 cm (Row x Plant)
- Date of transplanting : 16 October 2018
- Net experimental area : 81 m² (6 .0m x 13.5 m)
- Gross experiment area : 88.92 m² (6.20 m x 14.30 m)
- Width of irrigation path : 50 cm
- Number of plants per plot : 25
- Experimental design : Randomized Block Design

3.5. Treatment combination

S.No.	Treatment	Treatment Combination
1	T ₀	Control
2	T ₁	2% Panchagavya
3	T ₂	4% Panchagavya
4	T ₃	6% Panchagavya
5	T ₄	2% Panchagavya + 5% Vermiwash
6	T ₅	4% Panchagavya + 5% Vermiwash
7	T ₆	6% Panchagavya + 5% Vermiwash
8	T ₇	5% vermiwash

Fig.3.1 Layout plan of the experiment



T ₀	=	Control
T ₁	=	2% PG
T ₂	=	4% PG
T ₃	=	6% PG
T ₄	=	2% PG + 5% VM
T ₅	=	4% PG + 5% VM
T ₆	=	6% PG + 5% VM
T ₇	=	5% VM

Replication = 3
Treatment = 8
Net plot area = 1.5 x 1.5 m²
Gross plot area = 3.96 m²
Net experimental area = 81 m²
Total experimental area = 88.92 m²
Width of path = 50 cm



Plate no. 3.1 Over all view of the experimental field

3.6. Experimental Material

3.6.1. Planting Material

The corms of gladiolus variety Gunjan were procured from Department of Floriculture & Landscaping Architecture, Navsari Agriculture University, Gujarat.

3.6.2. Treatment Material

3.6.2.1 Vermiwash

Vermiwash were procured from Krishi Vighan Kendra (KVK), Jhalawar.

3.6.2.2. Panchagavya

Panchagavya was prepared by a modified method of Vriksha Ayurveda, a standardized method (Natarajan, 2002). The materials required and the methodology involved in the preparation is furnished below.

S.No.	Content
1	Cow dung – 10 kilograms
2	Cow urine – 3 litre
3	Cow milk – 2 litre
4	Curd – 1 litre
5	Ghee – 1 litre
6	Ripe Banana - 12 numbers



Plate no. 3.2 Treated corms



Plate no.3.3 preparation of panchagavya and vermiwash

3.7 Cultural operation

The details of cultural operations carried out during the course of investigation including the nursery operation are furnished below:

3.7.1 Preparation of experimental field

Field preparation was done by ploughing the field with mould board plough twice. Harrowing was done to break the clods. During bed preparation vermicompost was incorporated in the soil followed by leveling and weeding manually. The experiment was laid out with the help of measuring tape, rope and pegs.

3.7.2 Planting of corms

After field and plot preparations the varieties were allocated to experimental plots through randomization. In each replication fresh randomization was done for planting of corms. Treated corms (with bavistin 0.2%) were planted at a distance of 40 cm at depth of 8-10 cm on 16 October, 2018. While planting of corm care was taken to maintain the bud on top in vertical position. Total 25 corms of specific variety were planted in each plot.

3.7.3 Planted protection

The crops did not face any serious attack of disease and pest. Drenching of soil with bavistin @ 0.2% at fortnight interval was given as prophylactic measure.

3.7.4 Irrigation and weeding

The crop was irrigated at 10 days interval by check basin method depending on the prevailing weather conditions. Weeding was done with the help of hand hoe after 20 to 25 days of corm planting & the time of earthing up.

3.7.5 Earthing up

Earthing up of plants was also done after 40 days of planting to support the plant.

3.7.6 Harvesting of spikes

The spikes were harvested in early morning hours. Retaining 3 pairs of leaves on plant at two days interval.

3.7.7 Digging of corms and cormels

The corms and cormels were lifted from the ground after 65 days of harvesting of spikes when the leaves turned yellow and were half-dry in each plant. The corms and cormels were cured in shade for about a week and treated with bavistin (0.2%) before storing in cold storage.

3.8 Observation recorded

The following observations were recorded from the tagged plants at different stages of plant growth. The five plants from the Centre of plot were selected randomly in every plot for recording the data.

3.8.1 Vegetative parameters

3.8.1.1 Plant height

The height was recorded in centimeters from the base of plants (ground level) to the tip of spike in five tagged plants by meter scale at flowering stage and average value was worked out.

3.8.1.2 Number of leaves per plant

Numbers of leaves per plant were counted from the selected tagged plants and average was calculated.

3.8.1.3 Leaf length (cm.)

The length of 4th leaf from base was recorded in centimeters from base to tip of the leaf on each of five tagged plants using meter scale.

3.8.1.4 Leaf width (cm.)

The width of leaf which was also employed for measuring length was recorded from margin to margin at the middle of leaf of selected tagged plants and average was calculated.

3.8.1.5 Main collar diameter (cm.)

The collar diameter was measured in centimeter with the help of digital vernier calipers just above the ground level of each of five tagged plants and then average was calculated.

3.8.2 Floral characters

3.8.2.1 Days to spike emergence

Number of days taken for spike emergence from planting of corms was recorded for each of five tagged plants and average was calculated.

3.8.2.2 Days to first floret opening from spike emergence

Number of days taken from spike emergence to opening of first basal florets on spike of each five tagged plants was noted and average was calculated.

3.8.2.3 Number of florets per spike

Total number of florets produced on spike was counted for each five tagged plants and mean was calculated.

3.8.2.4 Number of spikes/m²

The total number of cut spike harvested per square meter was counted and mean was worked out.

3.8.3 Corm yield parameters

3.8.3.1 Number of corm per plant

The number of daughter corms produced per mother corm planted was counted for each of the five tagged plants and average was calculated.

3.8.3.2 Number of corm/m²

The total numbers of corms produced per square meter were counted and recorded which were having diameter of one inch or more.

3.8.3.3 Number of cormels per plant

The number of cormels produced per plant was counted on each of the five tagged plants which were having diameter less than one inch.

3.8.3.4 Number of cormels/m²

The number of cormels produced per square meter was counted and recorded which were having diameter less than one inch.

3.8.3.5 Diameter of corm (cm)

Corm diameter was measured in centimeter with the help of digital vernier calipers and the average was calculated.

3.8.3.6 Weight of cormels per plant (gm.)

The fresh weight of cormels produced per plant was recorded in gram with the help of digital balance (Sartorius) after lifting the cormels from each of the five tagged plants.

3.8.3.7 Weight of corm (gm)

Fresh weight of 10 randomly selected corms per treatment was recorded in grams with the help of digital balance (Sartorius) immediately after lifting the corms and the average was worked out.

3.8.4 Quality parameter

3.8.4.1 Number of florets per spike

Total number of florets produced on spike was counted for each of five tagged plants and average was calculated.

3.8.4.2 Spike girth (cm²)

The girth of spike was measured in centimeter with the help of digital vernier calipers about 2 cm below the first basal floret of the spike.

3.8.4.3 Spike length (cm)

Spike length was measured in centimeter from the spike emergence point to tip of the spike using meter scale from each of the five tagged plants.

3.8.4.4 Rachis length (cm)

Rachis length was measured in centimeter from base of first florets to tip of the spike after opening the last florets on each of the five tagged plants.

3.8.4.5 Floret diameter (cm)

Diameter of the second floret of spike produced on each of five tagged plants was measured in centimeter at fully opened stage using vernier caliper and then the average was calculated.

3.8.4.6 Vase life of spike (days)

The vase life of spike was measured by counting the number of days up to which the cut spike remained fresh (having at least three florets fresh and open) for this study three spike were kept in each vase in distilled water at room temperature and average was calculated.

3.8.4.7 Anthocyanin content (mg/100 gm)

Aliquots weighing 5.0g of the homogenized florets samples were dissolved in 25 ml methanolic hydrochloric acid (85:15) solution. The samples were kept for 24 hours at cool temperature (4-5 °C.) for the extraction of anthocyanin pigment. The flocculate was filtered off by a whattman paper no.1 and the absorbance of the resulting clear liquid was measured at 535nm in spectrophotometer (Model: systronics 118). Anthocyanin content was calculated using the following formula

$$\text{Anthocyanin (mg/100g pulp)} = \frac{\text{OD (ABS } 535\text{\AA)} \times \text{volume of solution}}{\text{Weight of sample} \times 98.2 \times 100} \times 100$$

3.9 Economics of cultivation

3.9.1 Cost of cultivation (Rs./ha)

The cost of the inputs prevailing at the time of cultivation was considered to work out the cost of cultivation which is given in rupees per hectare.

3.9.2 Gross income

Gross income was calculated on the prevailing market price for the produce.

3.9.3 Net income

The net income per hectare was calculated on the basis of gross income and cost of cultivation per hectare as follows;

$$\text{Net income} = \text{Gross income} - \text{Cost of cultivation}$$

3.4 Benefit cost ratio

The benefit: cost ratio was worked out by using the following formula:

$$\text{B:C ratio} = \frac{\text{Gross income (Rs./ha)}}{\text{Cost of cultivation (Rs./ha)s}}$$

3.10 Statistical analysis

Experiment data was recorded during the course of investigation for various characters under study were analyzed statistically as per the technique suggested by Panse and Sukhatme (1985).

CHAPTER -4

EXPERIMENTAL RESULTS

Results of the field experiment entitled “Effect of panchagavya and vermiwash on vegetative growth, yield and quality of *Gladiolus* (*Gladiolus hybridus* Hort.) cv. Gunjan” conducted during October 2018 to May 2019 at the Instructional Farm Department of Floriculture & Landscaping College of Horticulture & Forestry, Jhalrapatan Jhalawar. The data pertaining to growth parameters, flowering and yield attributes studies were subjected to statistical analysis. The results have also been presented graphically, wherever felt necessary for better understanding.

4.1 Vegetative parameters

4.2 Flowering and yield parameters

4.3 Corm yield parameters

4.4 Quality parameters

4.1 VEGETATIVE PARAMETER –

4.1.1 Plant height (cm)

The data regarding to effect of foliar spray of panchagavya and vermiwash on plant height have been shown in Table 4.1 and depicted in Fig.4.1.

The perusal of the data reveals that among the individual concentration of panchagavya and vermiwash, T₃ produced the taller plant (93.37 cm) while, the shortest was recorded in T₀ (79 cm). However, the increase in plant height with T₃ treatment was statistically at par with T₇ (90 cm).

Among the different combination of panchagavya and vermiwash significantly taller plant (103.33 cm) recorded in T₆ while, the shortest (79 cm) plant was recorded in T₀. Treatment T₆ was statistically at par with T₅ (100.33 cm) and T₄ (98.44 cm). It was further noted that plant height at T₃ and T₆ was 8.99% and 20.24 % higher over control.

Table 4.1 Effect of panchagavya and vermiwash on plant height (cm) and number of leaves per plant of Gladiolus variety Gunjan.

Treatment	Treatment combination	Plant height (cm)	Number of leaves per plant
T ₀	Control	79.00	7.10
T ₁	2% PG	81.32	8.06
T ₂	4% PG	83.41	8.53
T ₃	6% PG	93.37	9.26
T ₄	2% PG + 5% VM	98.44	9.43
T ₅	4% PG + 5% VM	100.33	10.00
T ₆	6% PG + 5% VM	103.33	10.26
T ₇	5% VM	90.00	8.80
S.Em.±		2.79	0.28
C.D. at 5%		8.47	0.86

Table 4.2 Effect of panchagavya and vermiwash on leaf length (cm), leaf width (cm) and main collar diameter (cm) of Gladiolus variety Gunjan.

Treatment	Treatment combination	Leaf length (cm)	Leaf width (cm)	Main collar diameter (cm)
T ₀	Control	37.33	3.00	1.733
T ₁	2% PG	40.78	3.46	1.91
T ₂	4% PG	42.33	4.1	2.03
T ₃	6% PG	48.32	4.71	2.42
T ₄	2% PG + 5% VM	49.00	4.94	2.68
T ₅	4% PG + 5% VM	53.14	5.02	2.92
T ₆	6% PG + 5% VM	54.44	5.36	3.15
T ₇	5% VM	45.33	4.38	2.24
S.Em.±		1.42	0.15	0.10
C.D. at 5%		4.32	0.47	0.33

Fig 4.1 Effect of panchagavya and vermiwash on plant height (cm) and number of leaves per plant of Gladiolus variety Gunjan.

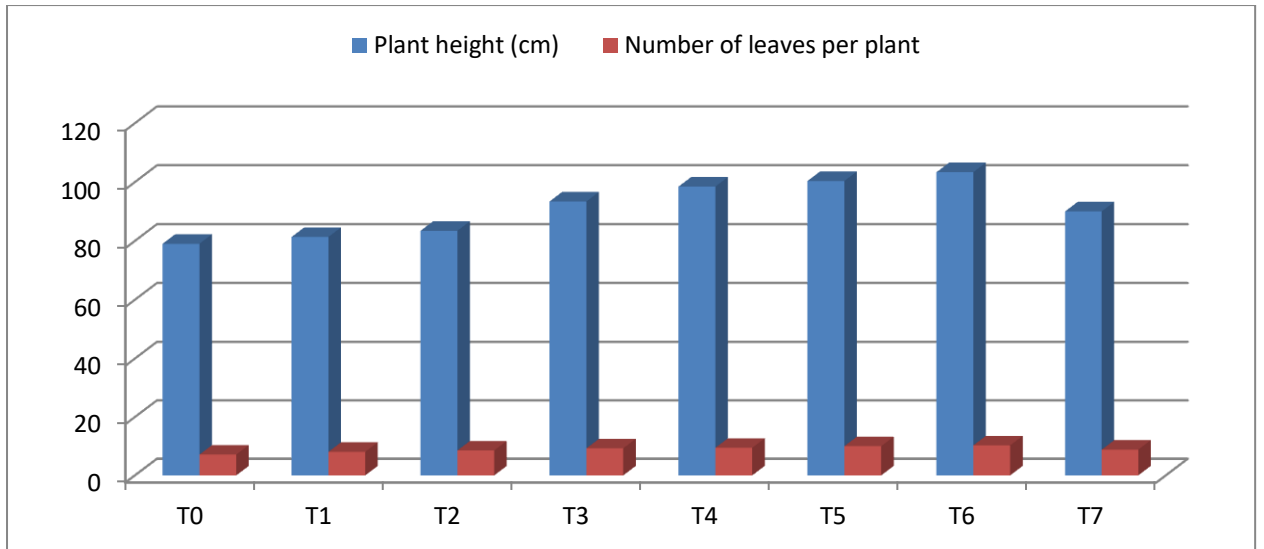
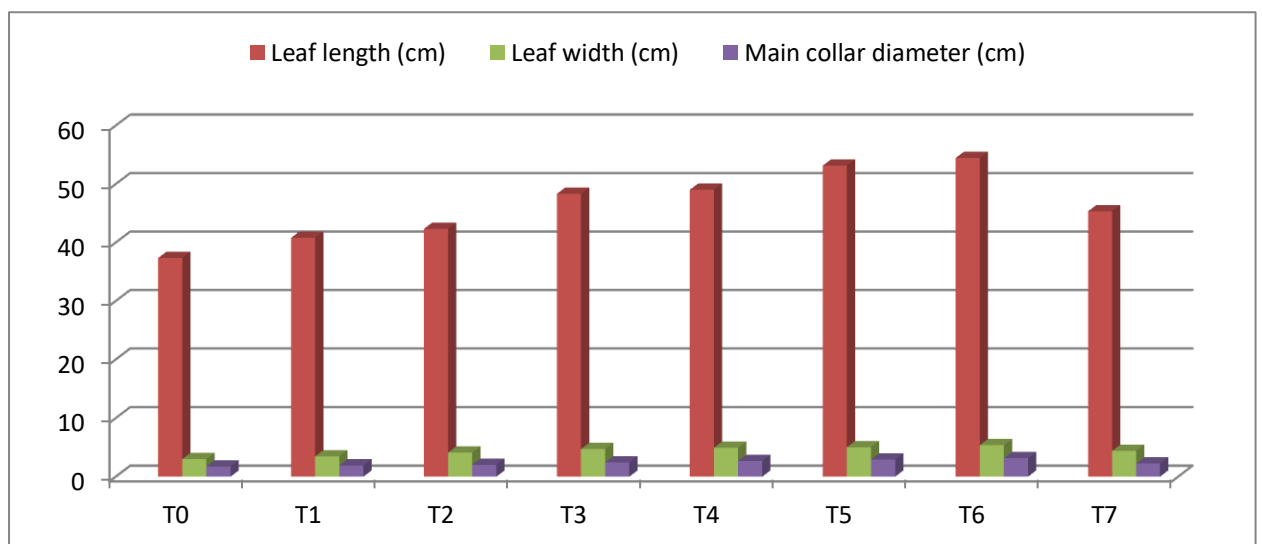


Fig 4.2 Effect of panchagavya and vermiwash on leaf length (cm), leaf width (cm) and main collar diameter (cm) of Gladiolus variety Gunjan.



4.1.2 Number of leaves per plant

The data belonging to the number of leaves per plant influenced by spray of panchagavya and vermiwash and their effect are presented in Table 4.1 and depicted in Fig. 4.1.

A keen observation of the data reveals that effect of foliar spray of sole concentration of panchagavya and vermiwash with treatment T₃ on number of leaves per plant was found significant. The number of leaves per plant was recorded maximum (9.26) while, minimum (7.10) in T₀ and found that T₃ had statistically at par with T₇ (8.80) and T₂ (8.53).

Similarly a significant effect of foliar spray of combination of panchagavya and vermiwash on number of leaves per plant was also recorded. The number of leaves per plant was recorded maximum (10.26) in T₆ while, minimum (7.10) was recorded in T₇. The increased number of leaves per plant with T₆ was statistically at par with T₅ (10) and T₄ (9.43). The result showed that combined application of 6% panchagavya + 5% vermiwash increases 30.71 % number of leaves more than control.

4.1.3 Leaf length (cm)

The data pertaining to leaf length affected by foliar spray of panchagavya and vermiwash and their effect have been shown in Table 4.2 and depicted in Fig. 4.2.

The bird eye view of the data reveals that foliar spray of panchagavya and vermiwash alone had significant effect on leaf length. The leaf length found to be maximum (48.32 cm) in T₃ while, minimum (37.33 cm) was observed in T₀. The increased leaf length of T₃ was statistically at par with T₇ (45.33 cm).

The combination of panchagavya and vermiwash had also recorded significant effect on leaf length. The maximum (54.44 cm) leaf length was shown in T₆ while, minimum (37.33 cm) was recorded in T₀. However, T₆ was statistically at par with T₅ (53.14 cm). It was also compared that in leaf length at T₃ and T₆ was 29.44 % and 45.83 % higher over control.

4.1.4 Leaf width (cm)

The analyzed data for width of leaves in different concentration treatment application have been presented in Table 4.2 and Fig. 4.2.

The observation of the data reveals that, foliar spray of sole concentration of panchagavya and vermiwash increased the leaf width higher over the control. The leaf width was maximum (3.71 cm) with treatment T₃ which were statistically at par with T₇ (4.38 cm) and T₂ (4.10 cm) while, minimum (3.00 cm) recorded in T₀.

The foliar spray of different combination of panchagavya and vermiwash on leaf width was also recorded during crop session. The maximum (5.36 cm) leaf width was recorded in T₆ while, minimum (3.00 cm) in T₀. The increased leaf width T₆ was statistically at par with T₅ (4.38 cm). It was parallel noted that in leaf width T₃ and T₆ was 57 % and 78.66 % higher over control

4.1.5 Main collar diameter (cm)

The data belonging to the main collar diameter as influenced by foliar spray of panchagavya and vermiwash and their effect are presented in Table 4.2 and depicted in Fig. 4.2.

The observation of the data reveals that effect of sole concentration of panchagavya and vermiwash significant effect on main collar diameter was recorded. The treatment T₃ was observed having maximum (2.42 cm) main collar diameter whereas, minimum (1.73 cm) recorded in T₀ as compare to other treatment. The increase in main collar diameter with T₃ treatment was statistically at par with T₇ (2.24 cm).

A significant of foliar spray of combination of panchagavya and vermiwash on main collar diameter was recorded with maximum (3.15 cm) under T₆ while, minimum (1.73 cm) in T₀. However, the increased main collar diameter of T₆ was statistically at par with T₅ (2.92 cm). It was analogize noted that in main collar diameter T₃ and T₆ was 39.88 % and 82.02 % higher over control.

4.2 FLOWERING AND YIELD PARAMETERS –

4.2.1 Days to spike emergence

The data regarding effect of panchagavya and vermiwash on days to spike emergence as presented in Table 4.3 and depicted in Fig. 4.3.

A keen observation of the data reveals that foliar spray of panchagavya and vermiwash had non - significant difference for days to spike emergence.

4.2.2 Days to first floret opening from spike emergence

The data pertaining to Days to first floret opening from spike emergence as influenced by foliar spray of panchagavya and vermiwash are presented in Table 4.3 and depicted in Fig. 4.3.

None of the treatments was found to be effective in increasing the days to first floret opening from spike emergence.

4.2.3 Number of spikes per plant

Data as regard to effect of foliar spray of panchagavya and vermiwash on number of spikes pre plant are presented in Table 4.4. depicted through Fig 4.4.

A close view of data illustrated that there were significant differences among the sole concentration for this treatment. The number of spikes per plant ranged between (1.00 – 1.60) spikes. Among sole concentration treatment of panchagavya and vermiwash T₃ produced maximum number of spike (1.60) per plant and minimum (1.00) in treatment T₀. This treatment was at par with T₇ (1.43).

Among combined application of panchagavya and vermiwash significant effect on number of spikes per plant was recorded maximum number of spikes (2.10) was recorded in T₆ while, minimum was recorded in T₀ (1.00). This treatment was found at par with T₅ (2.00) and T₄ (1.93).

Table 4.3 Effect of panchagavya and vermiwash on days to spike emergence and days to first floret opening from spike emergence of Gladiolus variety Gunjan.

Treatment	Treatment combination	Days to spike emergence	Days to first floret opening from spike emergence
T ₀	Control	52.00	8.60
T ₁	2% PG	55.06	8.46
T ₂	4% PG	49.06	8.60
T ₃	6% PG	53.73	8.53
T ₄	2% PG + 5% VM	53.06	9.93
T ₅	4% PG + 5% VM	51.46	9.26
T ₆	6% PG + 5% VM	52.40	8.86
T ₇	5% VM	54.60	8.86
S.Em.±		1.18	0.36
C.D. at 5%		NS	NS

Table 4.4 Effect of panchagavya and vermiwash on number of spikes per plant and number of spikes per square meter of Gladiolus variety Gunjan.

Treatment	Treatment combination	Number of spikes per plant	Number of spikes per (m²)
T ₀	Control	1.00	8.68
T ₁	2% PG	1.21	11.20
T ₂	4% PG	1.26	12.46
T ₃	6% PG	1.60	13.93
T ₄	2% PG + 5% VM	1.93	14.49
T ₅	4% PG + 5% VM	2.00	15.63
T ₆	6% PG + 5% VM	2.10	16.27
T ₇	5% VM	1.43	13.01
S.Em.±		0.05	0.40
C.D. at 5%		0.17	1.21

Fig 4.3 Effect of panchagavya and vermiwash on days to spike emergence and days to first floret opening from spike emergence of Gladiolus variety Gunjan.

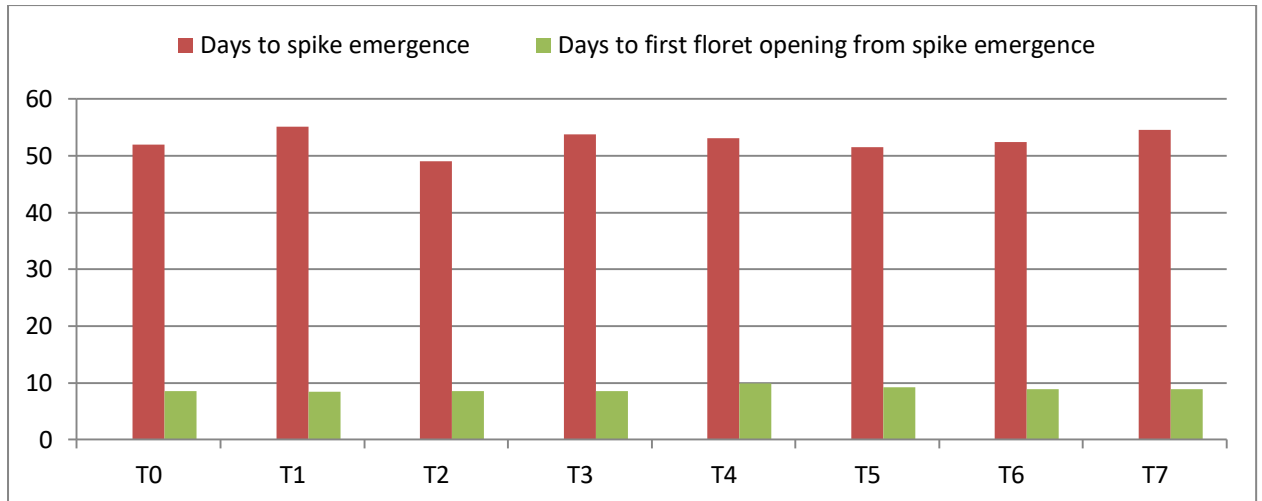
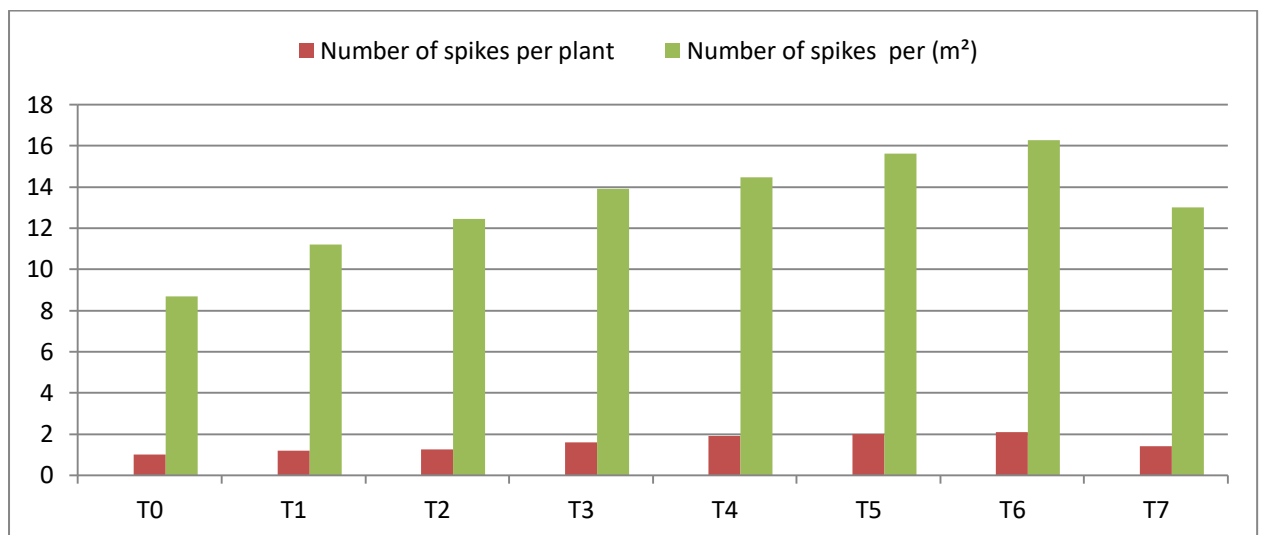


Fig 4.4 Effect of panchagavya and vermiwash on number of spikes per plant and number of spikes per square meter of Gladiolus variety Gunjan.



4.2.4 Number of spikes per (m²)

The data related to the spikes yield per square meter affected by foliar spray of panchagavya and vermiwash are presented in Table 4.4 and depicted in Fig. 4.4.

The foliar spray of sole concentration of panchagavya and vermiwash treatment T₃ was observed maximum (13.93) number of spikes per square meter whereas, minimum (8.68) in T₀ and treatment T₃ statistically at par with T₇ (13.01).

It is evident from the data that foliar spray of different concentration of panchagavya and vermiwash had significant effect on number of spikes per square meter. The number of spikes per square meter found maximum (16.27) in T₆ while, T₀ recorded minimum (8.68). Treatment T₆ is statistically at par with T₅ (15.63). It was associate noted that number of spike per square meter T₃ and T₆ had 60.48 % and 87.44 % higher over control.

4.3 CORM YIELD PARAMETER

4.3.1 Number of corms per plant

The data belonging to number of corm per plant as influenced by panchagavya and vermiwash and their effect are presented in Table: 4.5 and depicted in Fig: 4.5.

The perusal of data reveals that among particular concentration of panchagavya and vermiwash had recorded significant effect on number of corm per plant. The highest (1.63) number of corms per plant was recorded with T₃ which was at par with T₇ (1.50) whereas the least (1.06) number of corms per plant in control T₀.

Among the different concentration of panchagavya with vermiwash significant effect on number of corms per plant was recorded. The treatment T₆ had the maximum (2.06) number of corms was shown in T₆ while, minimum in T₀ (1.06). It was match found that, number of corms per plant T₃ and T₆ was 53.77 % and 94.33 % higher over control.

Table 4.5 Effect of panchagavya and vermiwash on number of corms per plant and number of corms per square meter of Gladiolus variety Gunjan.

Treatment	Treatment combination	Number of corms per plant	Number of corms per (m²)
T ₀	Control	1.06	10.33
T ₁	2% PG	1.20	11.00
T ₂	4% PG	1.36	12.33
T ₃	6% PG	1.63	13.66
T ₄	2% PG + 5% VM	1.73	15.33
T ₅	4% PG + 5% VM	1.80	16.00
T ₆	6% PG + 5% VM	2.06	16.66
T ₇	5% VM	1.50	13.33
S.Em.±		0.08	0.70
C.D. at 5%		0.25	12.1

Table 4.6 Effect of panchagavya and vermiwash on number of cormels per plant and number of cormels per square meter of Gladiolus varieties Gunjan variety Gunjan.

Treatment	Treatment combination	Number of cormels per plant	Number of cormels per (m²)
T ₀	Control	49.66	628.66
T ₁	2% PG	55.66	659.33
T ₂	4% PG	62.66	690.00
T ₃	6% PG	71.59	736.66
T ₄	2% PG + 5% VM	73.93	751.00
T ₅	4% PG + 5% VM	82.33	772.33
T ₆	6% PG + 5% VM	88.80	803.33
T ₇	5% VM	67.66	693.33
S.Em.±		2.26	21.56
C.D. at 5%		6.88	65.42

Fig 4.5 Effect of panchagavya and vermiwash on number of corms per plant and number of corms per square meter of Gladiolus variety Gunjan.

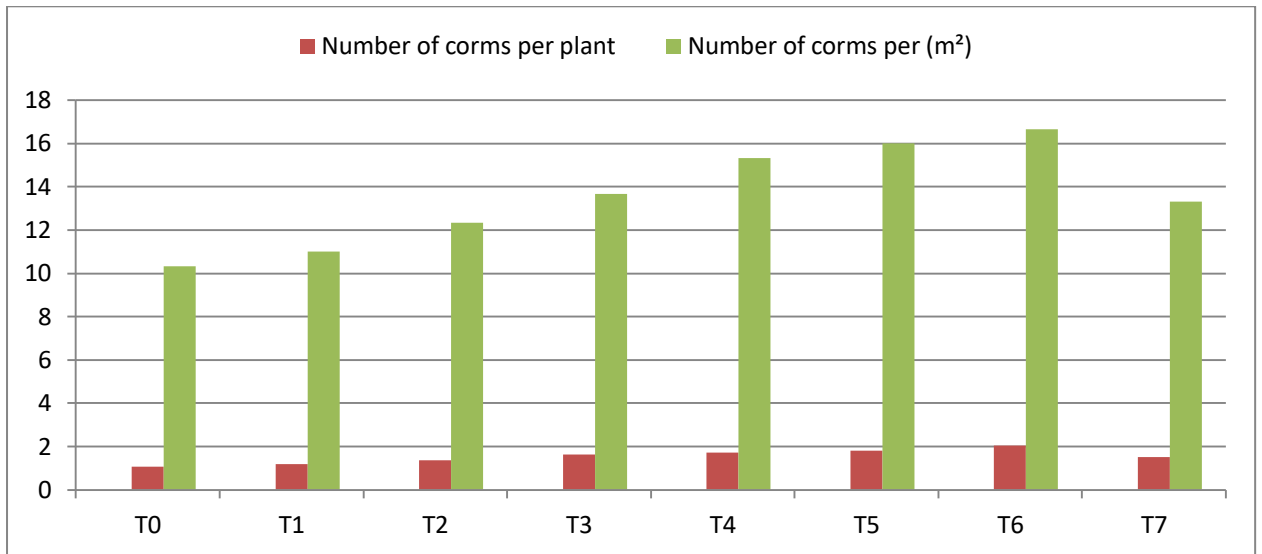
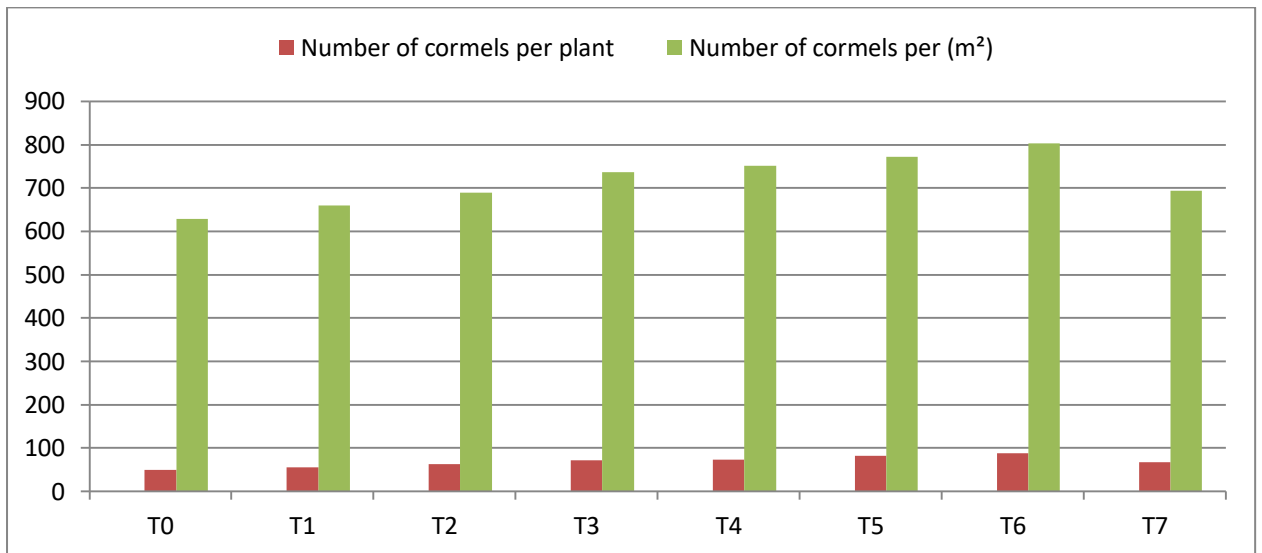


Fig 4.6 Effect of panchagavya and vermiwash on number of cormels per plant and number of cormels per square meter of Gladiolus varieties Gunjan variety Gunjan.



4.3.2 Number of corms per (m²)

The data regarding to effect of foliar spray of panchagavya and vermiwash on number of corms per square meter have been embodied in Table 4.5 and depicted Fig: 4.5.

A perusal of the data reveals that, foliar spray of individual concentration of panchagavya and vermiwash increased the number of corms per square meter. The number of corms per square meter was significantly higher (13.66) in the T₃ whereas, the minimum corms per square meter (10.33) recorded in T₀ as compare to other treatment. Treatment T₃ is statistically at par with T₇ (13.33) T₂ (12.33).

Similarly the significant effect of foliar spray of different combination of panchagavya and vermiwash on number of corms per square meter recorded. The number of corms per square meter had recorded maximum (16.66) in T₆ while, minimum (10.33) under T₀. However, increased number of corm per square T₆ was statistically at par with T₅ (16.00) and T₄ (15.33). It was liken noted that number of corms per square meter in T₃ and T₆ was 21.18 % and 60 % higher over control.

4.3.3 Number of cormels per plant

The data regarding effect of panchagavya and vermiwash on number of cormels per plant are presented in Table 4.6 depicted in Fig. 4.6.

A keen observation of the data reveals that effect of sole concentration of panchagavya and vermiwash with treatment T₃ on number of cormels per plant was found significant. The number of cormels per plant was recorded maximum (71.59) in T₃ while, minimum (49.66) in T₀ and found that T₃ had significantly at par with T₇ (67.66).

A significant influence of different concentration of panchagavya and vermiwash on number of cormels per plant was recorded with maximum (88.80) under T₆ while minimum (49.66) in T₀. However, the increased number of cormels per plant of T₆ was statistically at with T₅ (82.33). It was parallel found that in number of cormels per plant T₃ and T₆ was 22.33 % and 34.42 % higher over control.

4.3.4 Number of cormels per (m²)

The data related to the number of cormels per square meter affected by foliar spray of panchagavya and vermiwash and their effect are presented in Table 4.6 and depicted in Fig. 4.6.

The bird eye view of the data reveals that among the foliar spray of different concentration of panchagavya and vermiwash alone had significant effect on number of cormels per square meter also recorded. The maximum (736.66) number of cormels was found in T₃ followed by T₇ (693.33) and T₂ (690.00), while, minimum in T₀ (628.66).

The significant effect of foliar spray of combined concentration of panchagavya and vermiwash on number of cormels per square meter was also effective. The number of cormels per square meter had recorded maximum (803.33) in T₆ while, minimum (628.66) under T₀ and this was found significantly higher over all other treatments. It was parallel noted that, number of cormels per square meter T₃ and T₆ was 22.33 % and 34.42 % higher over control.

4.3.5 Diameter of corm (cm)

The data concerning diameter of corm as influenced by application of panchagavya and vermiwash have been presented in Table: 4.7 and depicted in Fig: 4.7.

It is evident from the data that foliar spray of sole concentration of panchagavya and vermiwash had recorded significant effect on diameter of corm. The maximum (4.76 cm) corm diameter was recorded in T₃ while, minimum (3.67 cm) diameter of corm was recorded in T₀. Treatment T₃ was statistically at par with T₇ (4.33 cm)

Among the different combination of panchagavya and vermiwash had recorded significant effect on diameter of corm. The maximum (5.56 cm) corm diameter was recorded in T₆ while minimum (3.67 cm) corm diameter was recorded in T₀. The increased corm diameter with T₆ was statistically at par with T₅ (5.35) and T₄ (5.22). It was associated noted that in T₃ and T₆ had 29.70 % and 51.49 % higher over control.

Table 4.7 Effect of panchagavya and vermiwash on diameter of corms (cm), weight of corm (g) and weight of cormels per plant of Gladiolus variety Gunjan.

Treatment	Treatment combination	Diameter of corm (cm)	Weight of corm (g)	Weight of cormels per plant (g)
T ₀	Control	3.67	41.61	20.90
T ₁	2% PG	4.11	50.25	23.93
T ₂	4% PG	4.18	50.66	25.48
T ₃	6% PG	4.76	55.53	30.15
T ₄	2% PG + 5% VM	5.22	56.36	34.67
T ₅	4% PG + 5% VM	5.35	59.13	36.67
T ₆	6% PG + 5% VM	5.56	62.59	38.83
T ₇	5% VM	4.33	53.03	27.26
S.Em.±		0.18	15.67	0.87
C.D. at 5%		0.56	47.55	2.66

Table 4.8 Effect of panchagavya and vermiwash on number of florets per spike and spike girth (cm²) of Gladiolus variety Gunjan.

Treatment	Treatment combination	Number of florets per spike	Spike girth (cm ²)
T ₀	Control	9.46	0.15
T ₁	2% PG	10.46	0.16
T ₂	4% PG	11.63	0.23
T ₃	6% PG	13.93	0.30
T ₄	2% PG + 5% VM	14.26	0.33
T ₅	4% PG + 5% VM	15.66	0.33
T ₆	6% PG + 5% VM	15.96	0.37
T ₇	5% VM	12.83	0.26
S.Em.±		0.50	0.007
C.D. at 5%		1.53	0.023

Fig 4.7 Effect of panchagavya and vermiwash on diameter of corms (cm), weight of corm (g) and weight of cormels per plant of Gladiolus variety Gunjan.

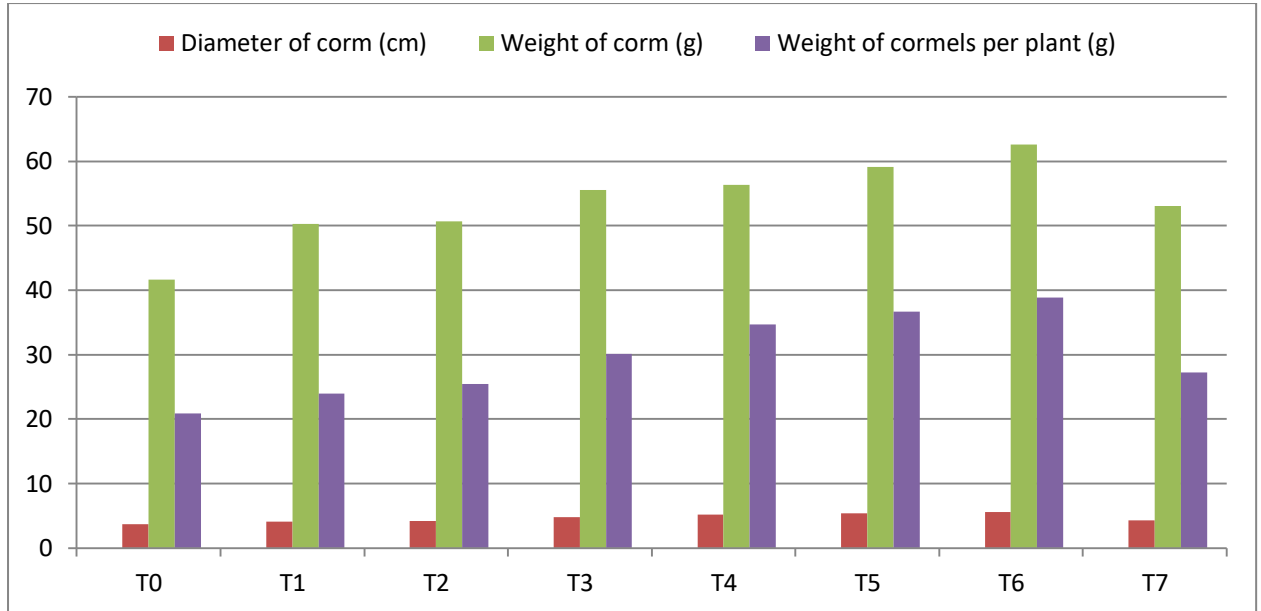
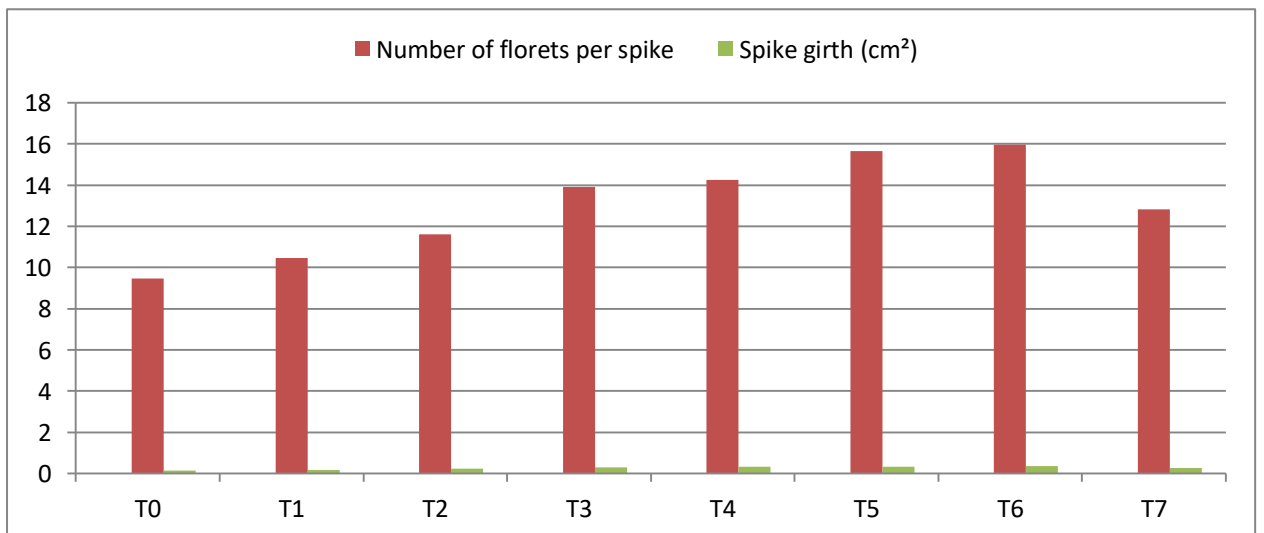


Fig 4.8 Effect of panchagavya and vermiwash on number of florets per spike and spike girth (cm²) of Gladiolus variety Gunjan.



4.3.6 Weight of corm (g)

The data concerning weight of corms per treatment as influenced by panchagavya and vermiwash and their effects have been embodied in Table: 4.7 and depicted in Fig: 4.7.

The observation of the data reveals that, effect of sole concentration of panchagavya and vermiwash increased the weight of corm per treatment significantly over the control. The maximum (55.53 g) corm weight was recorded in T₃ while, minimum (41.61 g) recorded in T₀. However, the increased corm weight of T₃ was statistically at par with T₇ (53.03 g) T₂ (50.66 g) and T₁ (50.25 g).

The effect of foliar spray of combined concentration of panchagavya and vermiwash was recorded maximum (62.59 g) weight of corm was recorded in T₆ while, minimum (41.61 g) in control. It is a statistically at par with T₅ (59.13 g). It was juxtapose that in weight of corm T₃ and T₆ had 33.43 % and 50.42 % higher over control.

4.3.7. Weight of cormels per plant (g)

The data pertaining to weight of cormels per plant as influenced by panchagavya and vermiwash and their effects have been recorded in Table: 4.7 and depicted in Fig: 4.7.

The bird eye view of the data reveals that, foliar spray of sole concentration of panchagavya and vermiwash had significant effect on weight of cormels per plant. The weight of cormels recorded maximum (30.15 g) in T₃ while, minimum (20.90 g) in T₀ respectively.

It is evident from the data that foliar spray of combined concentration of panchagavya and vermiwash had recorded significant effect on weight of cormels per plant. The maximum (38.83 g) weight of cormels per plant was recorded in T₆ while, minimum (20.90 g) weight of cormels per plant was recorded in T₀. Treatment T₆ was statistically at par with T₅ (36.67 g). It was recorded that weight of cormels per plant T₃ and T₆ was 44.25 % and 85.74% higher over control.

Table 4.9 Effect of panchagavya and vermiwash on spike length (cm) and rachis length (cm) of Gladiolus variety Gunjan.

Treatment	Treatment combination	Spike length (cm)	Rachis length (cm)
T ₀	Control	45.65	29.06
T ₁	2% PG	48.19	30.59
T ₂	4% PG	54.66	32.95
T ₃	6% PG	62.21	37.33
T ₄	2% PG + 5% VM	63.03	38.01
T ₅	4% PG + 5% VM	66.99	41.66
T ₆	6% PG + 5% VM	69.16	43.13
T ₇	5% VM	59.00	34.01
S.Em.±		1.96	1.12
C.D. at 5%		5.97	3.40

Table 4.10 Effect of panchagavya and vermiwash on floret diameter (cm), vase life of spikes (days) and anthocyanin content (mg/100 gm) leaf length (cm) of Gladiolus variety Gunjan.

Treatment	Treatment combination	Floret diameter (cm)	Vase life of spikes (days)	Anthocyanin content (mg/100 gm)
T ₀	Control	5.23	9.00	31.09
T ₁	2% PG	5.55	15.66	30.68
T ₂	4% PG	6.66	14.00	31.36
T ₃	6% PG	7.42	13.33	30.41
T ₄	2% PG + 5% VM	8.20	11.33	31.77
T ₅	4% PG + 5% VM	8.89	10.33	31.36
T ₆	6% PG + 5% SVM	9.30	9.66	32.04
T ₇	5% VM	7.00	12.66	30.82
S.Em.±		0.33	0.11	0.51
C.D. at 5%		1.00	0.33	NS

Fig 4.9 Effect of panchagavya and vermiwash on spike length (cm) and rachis length (cm) of Gladiolus variety Gunjan.

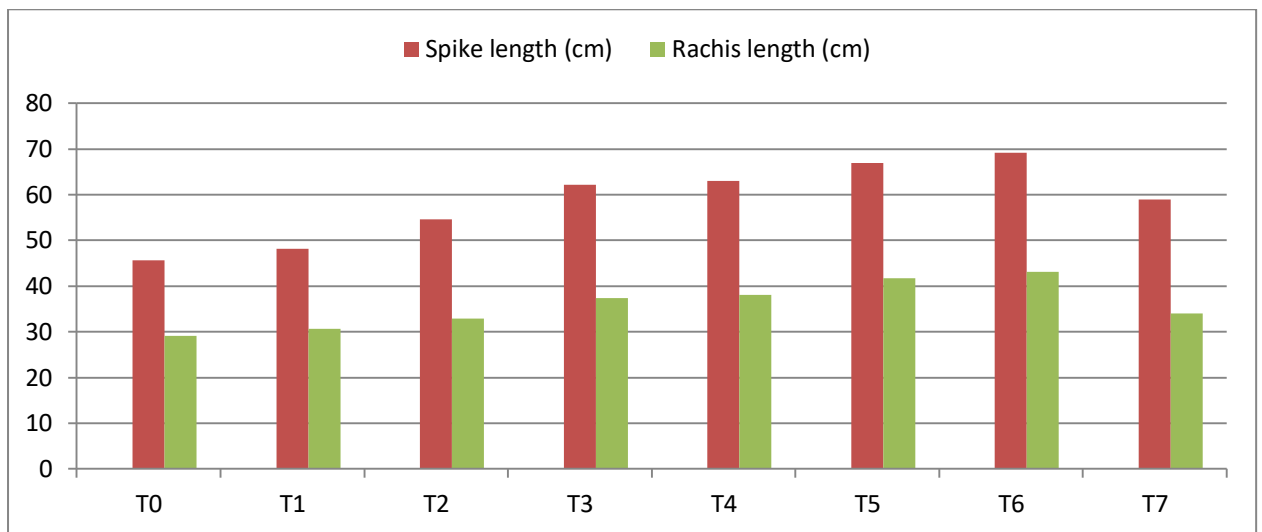
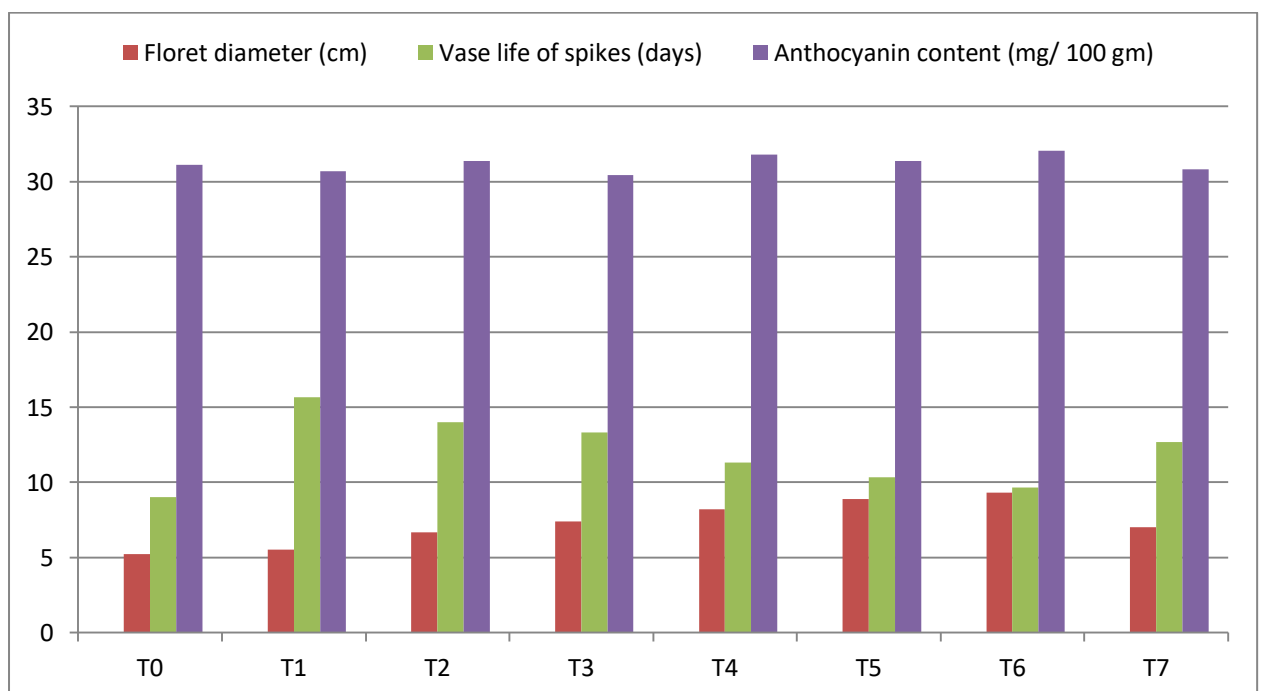


Fig 4.10 Effect of panchagavya and vermiwash on floret diameter (cm), vase life of spikes (days) and anthocyanin content (mg/100 gm) leaf length (cm) of Gladiolus variety Gunjan.



4.4 Quality parameter

4.4.1 Number of florets per spike

The data regarding effect of foliar spray of panchagavya and vermiwash on plant height have been shown in Table 4.8 and depicted in Fig.4.8.

The perusal of the data reveals that among the individual concentration of panchagavya and vermiwash, T₃ produced the maximum (13.93) number of florets per spike while, minimum (9.46) was recorded in T₀. However, the increase in number of florets per spike with T₃ treatment was statistically at par with T₇ (12.83).

Among the different combination of panchagavya and vermiwash significantly maximum (15.96) number of florets per spike was recorded in T₆ while, minimum (9.46) in control. Treatment T₆ was statistically at par with T₅ (15.66). It was further noted that number of florets per spike T₃ and T₆ 47.25 % and 68.7 % higher over control.

4.4.2 Spike girth (cm²)

The data belonging to the spike girth influenced by spray of panchagavya and vermiwash and their effect are presented in Table 4.8 and depicted in Fig. 4.8.

A keen observation of the data reveals that effect of foliar spray of sole concentration of panchagavya and vermiwash with treatment T₃ on spike girth was found significant. The spike girth was recorded maximum (0.30 cm²) while, minimum (0.15 cm²) in T₀.

Similarly a significant effect of foliar spray of combination of panchagavya and vermiwash on spike girth was also recorded. The spike girth was recorded maximum (0.37 cm²) in T₆ while, minimum (0.15 cm²) was recorded in T₀.



6%PG + 5VW



Control



6% PG + 5% VW



Control

Plate no. 4.1 Effect of panchagavya and vermiwash on gladiolus spikes and corm diameter

4.4.3 Spike length (cm)

The data pertaining to spike length affected by foliar spray of panchagavya and vermiwash and their effect have been shown in Table 4.9 and depicted in Fig. 4.9.

The bird eye view of the data reveals that foliar spray of individual concentration of panchagavya and vermiwash had significant effect on spike length. The spike length found to be maximum (62.21 cm) in T₃ while, minimum (45.65 cm) was observed in T₀. The increased spike length of T₃ was statistically at par with T₇ (59.00 cm).

The different concentration of panchagavya and vermiwash had also recorded significant effect on spike length. The maximum (69.16 cm) spike length was shown in T₆ while, minimum (45.65 cm) was recorded in T₀. However, T₆ was statistically at par with T₅ (66.99 cm). It was also compared that in spike length at T₃ and T₆ was 36.27 % and 51.50 % higher over control.

4.4.4 Rachis length (cm)

The analyzed data for rachis length in different concentration treatment application have been presented in Table 4.9 and Fig. 4.9.

The observation of the data reveals that, foliar spray of sole concentration of panchagavya and vermiwash increased the rachis length higher over the control. The rachis length was maximum (37.33 cm) with treatment T₃ while, the minimum (29.06 cm) was recorded under the T₀ which were statistically at par with T₇ (34.01 cm).

The foliar spray of different combination of panchagavya and vermiwash on rachis length was also recorded during crop session. The maximum (43.13 cm) rachis length was recorded in T₆ while, minimum (29.06 cm) in T₀. The increased rachis length of T₆ was statistically at par with T₅ (41.66 cm). It was parallel noted that in rachis length T₃ and T₆ was 28.45 % and 48.41 % higher over control.

4.4.5 Floret diameter (cm)

The data belonging to floret diameter influenced by foliar spray of panchagavya and vermiwash and their effect have been shown in Table 4.10 and depicted in Fig. 4.10.

The observation of the data reveals that effect of sole concentration of panchagavya and vermiwash was significant effect on floret diameter. The treatment T₃ was observed having maximum (7.42 cm) floret diameter whereas, minimum (5.23 cm) recorded in T₀ as compare to other treatment. The increase in floret diameter with T₃ treatment was statistically at par with T₇ (7.00 cm) and T₂ (6.66 cm).

A significance of foliar spray of combination of panchagavya and vermiwash on floret diameter was also recorded with maximum (9.30 cm) under T₆ while, minimum (5.23 cm) in T₀. However, the increased floret diameter of T₆ was statistically at par with T₅ (8.89 cm). It was analogize noted that in floret diameter T₃ and T₆ was 49.59 % and 87.70 % higher over control.

4.4.6 Vase life of spikes (days)

The data regarding effect of foliar spray of panchagavya and vermiwash on vase life of spikes have been shown in Table 4.10 and depicted in Fig.4.10.

A close view of data illustrated that there were significant differences among the sole concentration for this treatment. The vase life of spikes found maximum (15.66 days) in T₁ while, T₀ recorded minimum (9.00) vase life of spike.

Among the different combination of panchagavya and vermiwash significant effect on vase life of spikes was recorded. The maximum (11.33 days) vase life of flower was recorded in T₄ while, T₀ recorded minimum (9.00 days). It was differences found that in vase life of spikes T₁ and T₄ was 70.33 % and 25.88 % higher over control.

4.4.7 Anthocyanin content (mg/g)

The data regarding effect of foliar spray of panchagavya and vermiwash on anthocyanin content are presented in Table 4.10 and depicted in Fig. 4.10.

A keen observation of the data reveals that, foliar spray of panchagavya and vermiwash had no significant difference for anthocyanin content.



Plate no. 4.2 Vase life of spikes

Table 4.11: Benefit : Cost ratio

Treatment	Total cost of cultivation (Rs.)	Spike return (Rs/ha)	Corn return (Rs/ha)	Gross return (Rs/ha)	Net return (Rs/ha)	B:C ratio
T₀	414434	434000	550000	984000	569566	1.37
T₁	421334	560000	55000	1110000	688666	1.63
T₂	428234	623000	616500	1239500	811266	1.89
T₃	435134	696500	683000	1379500	944366	2.17
T₄	427084	724500	766500	1491000	1063916	2.49
T₅	433984	781500	800000	1581500	1147516	2.64
T₆	440884	813500	866500	1680000	1239116	2.81
T₇	420184	650500	66500	1317000	896816	2.13

Rate of spike: - Special grade @ Rs. 5, standard grade Rs. 4 and utility grade @ Rs.3

Rate of corm: - 2.5-4 cm size corm @ Rs. 3, 4-6 cm @ Rs. 4 and 6-8 @ Rs.5

CHAPTER -5

DISCUSSION

The result of the experiment entitled “Effect of panchagavya and vermiwash on vegetative growth, yield and quality of Gladiolus (*Gladiolus hybridus* Hort.) cv. Gunjan”, presented in the chapter revealed significant difference among sole and combined concentration of foliar spray for various vegetative, yield and quality character. The observed result have been discussed in this chapter considering findings of earlier research works.

5.1 EFFECT OF PANCHAGAVYA AND VERMIWASH-

5.1. Vegetative parameters –

5.1.1 Plant height (cm)

It is clear from the results of present study that, the individual concentration of panchagavya and vermiwash had significantly affected the plant height. Application of treatment T₃ recorded the highest (93.37 cm) plant height while, the lowest (79 cm) plant height under control T₀. The presence of effective microorganisms and methylotrophs profile bacteria in the panchagavya enhanced the production of phytohormones like auxins and gibberellins that might have stimulated the growth by increasing the plant height (Xu, 2000). Similar findings were given by Papen *et al.* (2002), Lourduraj *et al.* (2005), Sankari, (2015) and Bhalla *et al.* (2006) in gladiolus.

Among the combined concentration of panchagavya and vermiwash highest (103.33 cm) plant height of the plant were recorded under T₆ while, minimum (79 cm) were registered under the control T₀. Significant variation was reported among panchagavya with respect to plant height. The possible reason for higher growth characters and increased plant height might be due to the presence of growth enzymes like GA₃ oxidase and GA₂ oxidase in panchagavya (Vasumathi, 2001), which favoured rapid cell division and multiplication as well as helps in enhancement of biological efficiency of crop plant. Presence of growth regulatory substance such as Indole acetic acid (IAA), Gibberellin (GA₃), cytokinin and essential plant nutrients from panchagavya caused a stimulatory effect on the growth rate of plant. The increased

plant height might be due to increased avidity of more exchangeable nutrients in the soil by application of vermiwash (Cook *et al.*1980).

5.1.2 Number of leaves per plant

The sole concentration of panchagavya and vermiwash had significantly affected the number of leaves. The highest (9.26) number of leaves per plant were recorded under T₃ whereas; minimum (7.10) numbers of leaves per plant were registered under the control T₀. In the present study, the number of leaves of the plant was increased with increasing higher concentration of panchagavya. The increase in number of leaves due to the higher dose of panchagavya might be due to the fact that, panchagavya applied as foliar nutrition contains nitrogen in available form and also presence of growth promoting substance such Gibberellins and cytokinin, which are known to increase the number of leaves. These results confirm the report of Somasundaram *et.al.* (2004) and Renukaradya, (2005) in carnation.

In application of combined concentration of panchagavya and vermiwash, the maximum (10.26) number of leaves per plant were recorded under T₆ while, minimum (7.10) number of leaves per plant were registered under the control T₀. Increase in the number of leaves may be due to quick absorption of nitrogen, which was received by plants through panchagavya. Influence of nitrogen in promoting vegetative growth is a well-established fact that nitrogen increases number of leaves through its effect on rapid meristematic activity. This is in accordance with the result obtained Waheeduzauma *et al.* (2007) in anthurium, Bhalla *et al.* (2006) in gladiolus and Renukaradya, (2005) in carnation. Spraying of vermiwash might have influenced in number of leaves since it consists of cytokinin, auxin, amino acid and vitamins which might have helped in increasing number of leaves (Ansari and Kumar, 2010).

5.1.3 Leaf length (cm)

The foliar spray of sole concentration of panchagavya and vermiwash improved the leaf length of the plant as compared to control. Treatment T₃ recorded the highest (48.32 cm) leaf length whereas, lowest (37.33 cm) leaf length were recorded under T₀. In the current investigation it was observed that, production of more number of leaves might be because presence of nitrogen in panchagavya and nitrogen increased the vegetative growth, more transportation and utilization of photosynthetic products resulting in increase in plant height together leaf length of leaves (Khimani, 1995). The

finding corroborates the reports of Tosar, (1989), Singatkar *et al.* (1995) and Sharma, (2002) in gaillardia, Jadhav and Singh, (2007) in anthurium and Maheta *et al.* (2016) in China aster.

Among the combined concentration of panchagavya and vermiwash T₆ recorded the maximum (54.44 cm) leaf length while, the minimum (37.33 cm) leaf length recorded in control. Panchagavya increased the leaf length because presence of nitrogen in panchagavya increases the vegetative growth, more transportation and utilization of photosynthetic products resulting in increase in plant height together leaf length of leaves (Khimani, 1995 in gaillardia). The finding corroborates the reports of Tosar, (1989), Singatkar *et al.* (1995) and Sharma, (2002) in gaillardia, Jadhav and Singh, (2007) in anthurium and Maheta *et al.* (2016) in China aster. It may be due to vermiwash which induced various enzymes cocktail of protease, amylase and phosphate. These are beneficial for growth and development of plant. Which increases plant growth and development (Kaur,2015), These result are in agreement with the finding of Karuna *et al.* (1999) in *Anduriumandreanum* Linn, Elumalai *et al.* (2013) in okra and Hatti *et al.* (2010).

5.1.4 Leaf width (cm)

It is evident from the data that, the leaf width of the plant significantly increased due to individual concentration of panchagavya and vermiwash. Application of panchagavya treatment T₃ recorded the maximum (4.71 cm) leaf width while, the minimum (3.00 cm) leaf width with under control T₀. Spray of panchagavya increased the leaf width may be due to enhanced levels of cytokinin, thereby manifold increase in cell division resulting in enhanced leaf width (Sankari, 2015) Similar results were also reported by Suguna, (2005) in carnation.

In foliar spray of combined concentration of panchagavya and vermiwash had significantly affected the leaf width. The results showed that, the highest (5.36 cm) leaf width of the plant were recorded under T₆ whereas, minimum (3.00 cm) leaf width of the plant were recorded under the control T₀. It may be due to the presence of growth regulatory substance such as IAA, GA, cytokinin, essential plant nutrient, effective microorganism and biofertilizer like *Acetobacter*, *Azosprillum* and phosphobacteria in panchagavya (Somasundran *et al.* 2004). These results confirm the report of Renukaradya, (2005) in carnation and Vimalendran and Wahab, (2013) in babycorn.

5.1.5 Main collar diameter

The foliar spray of sole concentration of panchagavya and vermiwash had significantly increased the main collar diameter. Application of panchagavya (T₃) recorded the maximum (2.42 cm) main collar diameter while, the minimum (1.73 cm) main collar diameter recorded under the control. The increased main collar diameter might be due to increased vegetative growth like number of leaves, chlorophyll contents. This is in accordance with the result obtained by Waheeduzauma *et al.* (2007) in anthurium and Bhalla *et al.* (2006) in gladiolus.

Among the combination of panchagavya and vermiwash, T₆ recorded maximum (3.15 cm) main collar diameter while, minimum (1.73 cm) main collar diameter was recorded under the control T₀. It may be due to increased vegetative growth, chlorophyll content and number of leaves, which ultimately resulted in increased main collar diameter. The result also found support from earlier works of Waheeduzauma *et al.* (2007) in anthurium and Bhalla *et al.* (2006) in gladiolus.

5.2. Flowering and yield parameters –

5.2.1 Number of spikes per plant

Present investigation reveals that, sole concentration of panchagavya and vermiwash progressively increased the number of spike per plant as compared to control. Application of panchagavya treatment T₃ recorded the maximum (1.60) number of spike per plant while, the minimum (1.00) number of spike with under control T₀. Presence of growth regulatory substance as well as effective microorganism might have contributed for spike per plant. The results are in conformity with finding of Somasundaram *et al.* (2005) and Sinta, (2007) in gladiolus.

Among the application of combined concentration of panchagavya and vermiwash T₆ recorded the highest (2.1) number of spike per plant while, the lowest (1.00) number of spike per plant as compared to control (T₀). Panchagavya increased the number of spike per plant due to bio – inoculants such as *Azotobacter*, *Azospirillum* and phosphobacteria present in panchagavya, which is responsible for increasing the number of spike due to better vegetative growth. Similar result also reported from the previous worker of Somasundaram *et al.* (2005) and Sinta, (2007) in gladiolus. An increase in number of spike per plant was also observed due to vermiwash spray. This

might have been aided by the balanced nutrition made available to the crop by the production of auxin like growth substance by vermiwash at earlier phase of development. (Sankari *et al.* 2015). Similar results have also reported by Tamrakar *et al.* (2018) in gladiolus.

5.1.2 Number of spikes per square meter

The effect of foliar spray of sole concentration of panchagavya and vermiwash increase the number of spike per plant significantly over the control. The maximum (13.93) number of spike per square meter recorded under T₃ while, the minimum (8.68) number of spike per square meter in control (T₀). This was mainly due to number of spike per square meter directly correlated to number of spike per plant. The results are conformity with findings of Sankari *et al.* (2015) in gladiolus.

Application of combined concentration of panchagavya and vermiwash had significantly affected the number of spike per square meter. The highest (16.27) number of spike per square meter was recorded under T₆ whereas, the lowest (8.68) number of spikes in control (T₀). Number of spike per square meter was directly correlated with number of spikes per plant. The present findings are also supported by reports of Sankari *et al.* (2015) in gladiolus and Yathisha *et.al.* (2008) in tuberose.

5.3. Corm yield parameters –

5.3.1 Number of corm per plant

The foliar spray of sole concentration of panchagavya and vermiwash improved number of corm per plant as compared to control. Treatment T₃ recorded the maximum (1.63) number of corm per plant while, the minimum (1.06) number of corm per plant with under control (T₀). Presence of growth regulatory substance such as GA₃ in panchagavya (Somasundaram *et.al.* 2004), which promoted the active cell division, enlargement and elongation thereby increasing the rate of photosynthesis which enhanced carbohydrate fixation in the sink (Joshi *et al.* 2011)

Application of combined concentration of panchagavya, T₆ produced the maximum number of corm per plant (2.06) while, the minimum (1.06) number of corm per plant with under control T₀. Available of growth regulatory substance such as GA₃ in panchagavya (Somasundaram *et.al.* 2004). It may be due to growth promoted the

active cell division, enlargement and elongation thereby increasing the rate of photosynthesis which enhanced carbohydrate fixation in the sink (Joshi *et al.*, 2011) Presence of growth promoting substance auxin like IAA in vermiwash might be increased the number of corm (Tamakar, 2018). The results in are conformity with the findings of Ramachandure and Thangam, (2008) in gladiolus.

5.3.2 Number of corms per square meter

It is evident from the result that, the number of corm per square meter increased irrespective of sole concentration of panchagavya and vermiwash. Treatment T₃ recorded maximum (13.66) number of corm per square meter whereas, the minimum (10.33) in T₀. The number of corm per square meter appeared to be directly correlated to number of corms per plant as evident from the result are conformity with the findings of Pandey and Sinha (2006).

In foliar spray of combined concentration of treatment T₆ had the maximum (17.33) number of corm per square meter while, the minimum (11.00) number of corm per square meter with under control T₀. It is evident from the result that the estimated number of corms per square meter was directly associated with number of corms per plant (Pandey and Sinha 2006).

5.3.3 Number of cormels per plant

The analysis of data reveals that, the sole concentration of panchagavya and vermiwash had significantly affected the number of cormels per plant. In foliar spray of panchagavya (T₃) recorded the highest (71.59) number of corm per plant while, the lowest (49.66) number of corm per plant compared to control (T₀). Panchagavya applied as foliar nutrition contains nitrogen in available form (Somasundaram *et.al.* 2004), which increased the total number of leave of the plant causing high dry matter accumulation in the plant and its greater mobilization in cormels hence produced better cormels Singh (2006) in gladiolus.

The result observed that, among the application of combined concentration of panchagavya and vermiwash, T₆ produced the maximum number of cormels per plant (88.80) while, the minimum number of corm per plant (49.66) in control (T₀). Presence of GA₃ in panchagavya influenced the cormels production due to more production of

food material by increased photosynthetic area and enhanced physiological activities leading to increased number of cormels per plant in gladiolus (Joshi *et al.* 2011). The present results are in agreement with Bhalla *et al.* (2006) in gladiolus.

5.3.4 Number of cormels per square meter

Present investigation reveals that, individual concentration of panchagavya and vermiwash progressively increased the number of cormels per square meter compared to control. In foliar spray, treatment T₃ recorded maximum (736.66) number of cormels per square meter while, the minimum (628.66) number of cormels per square meter with under control T₀. The number of cormels per square meter appeared to be directly correlated to number of cormels per plant as evident from the result. The result also leads support from report of Bhalla *et al.* (2006) in gladiolus.

Application of different combined concentration of panchagavya and vermiwash had recorded significant effect on number of cormels per square meter. Treatment T₆ recorded maximum (803.33) number of cormels per square meter while, the minimum (628.66) number of cormels per square meter with under control (T₀). The number of corm per square meter appeared to be directly correlated to number of corms per plant as evident from the result. Similar results have been reported by Bhalla *et al.* (2006) in gladiolus.

5.3.5 Diameter of corm (cm)

The application of sole concentration of panchagavya and vermiwash had significantly affected the floret diameter. The maximum (4.76 cm) corm diameter observed in T₃ while, the minimum (3.47 cm) corm diameter in control (T₀). Presence of GA₃ contain in panchagavya. It may be due to involvement in cell division, cell expansion and increased volume of intercellular spaces in the mesocarpic cells (Baskaran *et al.* 2014).

Increase in diameter of corm increased with the successive combined concentration of panchagavya and vermiwash, Treatment T₆ recorded the maximum (5.56 cm) diameter of corm while, the minimum (3.47 cm) diameter of corm with under control (T₀). Presence of GA₃ in panchagavya and vermiwash increased the number of leaves and photosynthetic area leading to higher photosynthetic assimilates in sink. (Baskaran *et al.* 2014).

5.3.6 Weight of corm (g)

It is evident that, weight of corm significantly increased due to sole concentration of panchagavya and vermiwash treatment as compared to control. Application of panchagavya (T₃) recorded highest (55.53 g) weight of corm while, the lowest (41.61 g) weight of corm with under control (T₀). Available of nitrogen content in panchagavya, may be increased photosynthetic area, which in turn resulted in more accumulation of assimilates and partitioning to the developing corm (Kathiresan and Venkatesha 2000) in gladiolus.

Among the foliar spray of combined concentration of panchagavya and vermiwash treatment T₆ recorded the highest (62.59 g) weight of corm whereas, the lowest (41.61 g) weight of corm in control (T₀). Presence of nitrogen and phosphorus contain in panchagavya and vermiwash, it might be due promoted vegetative growth, fresh and dry matter production and partition to the developing corm (Kathiresan and Venkatesha 2000) in gladiolus.

5.3.7 Weight of corms per plant (g)

The analysis of data reveals that, the alone concentration of panchagavya and vermiwash had significantly affected the weight of corms per plant. The foliar spray of panchagavya, treatment T₃ recorded maximum (30.15 g) weight of corms per plant while, the minimum (20.90 g) weight of corms per plant in control (T₀). Nitrogen and phosphorus nutrient found in panchagavya, this might be due to increased photosynthetic activity to produced additional biomass, which was manifested in bigger and heavy corms (Pandey and Sinha 2006).

The weight of corms per plant found to be maximum (38.83 g) in combined concentration of treatment T₆ while, the minimum (20.83 g) weight of corms per plant with under control (T₀). Nitrogen and phosphorus element present in panchagavya and vermiwash. This may be due to the fact that there was increase in the supply of nutrient was increased corms per plant (Pandey and Sinha 2006).

5.4. Quality parameters –

5.4.1 Number of florets per spike

The application of sole concentration of panchagavya and vermiwash had significantly affected the number of florets per spike. Application of panchagavya (T₃) recorded the highest (13.93) number of florets per spike while, the lowest (9.46) number of florets per spike in control (T₀). This might be due to activity of panchagavya consisting of active phenolic group that might have inhibited oxidase activity and promoted the prolonged persistence of IAA in plants which might have contributed to the increased number of florets per spike (Sankari *et al.* 2015) in gladiolus. Similar result also reported that of Somasundaram *et al.* (2005) and Sinta (2007) in gladiolus.

The result observed that, among the spraying of combined concentration of panchagavya and vermiwash, treatment T₆ produced the maximum (15.96) number of florets per spike while, the minimum (9.46) number of florets per spike in control (T₀). Panchagavya may be due to the presence of beneficial microbes would be at the higher rate and they helps in synthesis of growth promoting substance that might have increases number of floret Waheeduzzama (2007) in anthurium and Bhalla *et al.* (2006) in gladiolus. Maximum number of floret per spike might be due to presence of growth promoting substance like essential plant nutrient, vitamins, enzymes and antibiotics in vermiwash. The results also found support from earlier works of Patel *et al.* (2011) in African marigold and Kumar *et al.* (2010) in gladiolus.

5.4.2 Spike girth (cm²)

The analysis of data reveals that, the individual concentration of panchagavya and vermiwash had significantly affected the spike girth of the plant. Application of panchagavya (T₃) recorded the maximum (0.30 cm²) spike girth of the plant. This may be due to application of panchagavya at higher concentration as foliar spray increased vegetative growth like number of number leaves, chlorophyll content as well as root growth the (Yathisha *et al.* 2008). Similar results were also obtained by Renukaradya (2005) in carnation and Nethra (1996) in China aster.

Among the combined concentration of panchagavya and vermiwash treatment T₆ recorded highest (0.37 cm²) spike girth while, the lowest (0.15 cm²) spike girth under control (T₀). The increased spike girth diameter might be due to increased vegetative growth like number of number leaves, chlorophyll content as well as root growth (Yathisha *et al.* 2008).

5.4.3 Spike length (cm)

It is clear from the results of present study that, the individual concentration of panchagavya and vermiwash treatments had significantly affected the spike length. Application of treatment T₃ recorded the highest (62.21 cm) spike length while, the lowest (45.65 cm) spike length under control (T₀). This might be due to the proportion and activity of beneficial microbes would be at the higher rate in panchagavya, which helps in synthesis of growth promoting substance that might have increase the length of spike (Yathisha *et al.*, 2008).

In foliar spray of the combined concentration of panchagavya and vermiwash, highest (69.16 cm) spike length recorded under T₆ while, minimum (45.65 cm) spike length registered under the control (T₀). Significant variation was reported among panchagavya with respect to spike length. This may be due to panchagavya induced better nutrient uptake, photosynthesis and source and sink relationship besides excellent physiological and biochemical activities (Yathisha *et al.* 2008). This results were also reported Waheeduzzama (2007) in anthurium, Bhalla *et al.* (2006) in gladiolus and Renukaradhya (2005) in carnation.

5.4.4 Rachis length (cm)

The foliar spray of individual concentration of panchagavya and vermiwash improved the rachis length of the spike. In the present study, treatment T₃ recorded the highest (37.33 cm) rachis length whereas, lowest (29.06 cm) rachis length were recorded under (T₀). This might be due to the proportion and activity of beneficial microbes would be at the higher rate in panchagavya, which helps in synthesis of growth promoting substance that might have increased the length of spike. (Yathisha *et al.* 2008).

Among the combined concentration of panchagavya and vermiwash, T₆ recorded the highest (43.13 cm) rachis length while, the lowest (29.06 cm) rachis length recorded in control (T₀). This may be due to panchagavya induced better nutrient uptake, photosynthesis and source and sink relationship besides excellent physiological and biochemical activities (Waheeduzzama 2007). This result was obtained by Bhalla *et al.* (2006) in gladiolus and Renukaradhya (2005) in carnation. This might be due to the vermiwash promoted the microbial activity of the tissue and expansion of cells (Tamrakar 2018). Similar finding were also reported by Ansari, (2008).

5.4.5 Floret diameter (cm)

The effect of foliar spray of sole concentration of panchagavya and vermiwash increased the floret diameter significantly over the control. The maximum (7.42 cm) floret diameter recorded under T₃ whereas, the minimum (5.23 cm) floret diameter with under control (T₀). It may be due to better sink and source relations and faster mobilization of photosynthesis, which might have resulted in increased floret diameter (Bhalla *et al.* 2006 and Renukaradhya (2005) in carnation.

Application of combined concentration of panchagavya and vermiwash had significantly affected the floret diameter. The maximum floret diameter (9.30 cm) was recorded under T₆ while, the minimum (5.23 cm) floret diameter in control (T₀). It may be due to better sink and source relations and faster mobilization of photosynthates, which might have resulted in increased floret diameter (Bhalla *et al.*, 2006) and Renukaradhya, (2005) in carnation.

5.4.6 Vase life of spikes (days)

Present investigation reveals that, individual concentration of panchagavya and vermiwash progressively increased the vase life of spikes as compared to control. Treatment T₂ recorded the maximum (15.66 days) vase life of spikes while, the minimum (9.00 days) vase life of spikes with under control (T₀). It may be due to lower concentration of panchagavya increased maximum water uptake and vase life (Yathisha *et al.* 2008), which reduced vase life may be due to increased N rates at higher concentration (Anuradha *et al.* 1990). The results are in conformity with the finding of Renukaradya (2005) in carnation and Rajesh *et al.* (2006) in gladiolus.

The foliar spray of combined concentration of panchagavya and vermiwash had significantly affected the vase life of spikes. Treatment T₄ recorded maximum (11.33 days) vase life of spikes while the minimum (9.00 days) vase life of spikes in control. The presence of panchagavya might growth promoting substance like cytokinin might be responsible for longer vase life (Yathisha *et al.* 2008). The results are in conformity with the finding of Renukaradya (2005) in carnation and Rajesh *et al.* (2006) in gladiolus.

A field experiment entitled “**Effect of panchagavya and vermiwash on vegetative growth, yield and quality of Gladiolus (*Gladiolus hybridus* Hort.) cv. Gunjan**” was carried out during September 2018 to May 2019 at the farm of the, College of Horticulture & Forestry, Jhalawar following Randomized Block Design. The observations were recorded on vegetative growth, yield and quality parameters. The experimental results presented and discussed in the previous chapters are summarized here with following heads:

- The maximum plant height (93.37 cm) was observed at T₃ (6% PG) while, the minimum plant height (79 cm) at T₀ and the maximum plant height (103.33 cm) was observed at T₆ (6% PG + 5% VM) while, the minimum plant height (79 cm) at T₀.
- The maximum number of leaves per plant (9.26) was noted at T₃ (6% PG) while, the minimum number of leaves per plant (7.10) at T₀ and the maximum number of leaves (10.26) was observed at T₆ (6% PG + 5% VM) while, the minimum number of leaves per plant (7.10) at T₀.
- The maximum leaf length (48.32 cm) was observed at T₃ (6% PG) while, the minimum leaf length (37.33 cm) at T₀ and the maximum leaf length (54.44 cm) was observed at T₆ (6% PG + 5% VM) while, the minimum leaf length (37.33 cm) at T₀.
- The maximum leaf width (4.71 cm) was noted at T₃ (6% PG) while, the minimum leaf width (3.00 cm) at T₀ and the maximum leaf width (5.36 cm) was observed at T₆ (6% PG + 5% VM) while, the minimum leaf width (3.00 cm) at T₀.
- The maximum main collar diameter (2.42 cm) was showed at T₃ (6% PG) while, the minimum main collar diameter (1.73 cm) at T₀ and the maximum main collar diameter (3.15 cm) was observed at T₆ (6% PG + 5% VM) while, the minimum main collar diameter (1.73 cm) at T₀.
- The maximum number of spikes per plant (1.60) was noted at T₃ (6% PG) while, the minimum number of spikes per plan (1.00) at T₀ and the maximum number of spikes per plant (2.10) was observed at T₆ (6% PG + 5% VM) while, the minimum number of spikes per plant (1.0) at T₀.

- The maximum number of spikes per square meter (13.93) was showed at T₃ (6% PG) while, the minimum number of spikes per meter square (8.68) at T₀ and the maximum number of spikes per square meter (16.27) was observed at T₆ (6% PG + 5% VM) while, the minimum number of spikes per square meter (8.68) at T₀.
- The maximum number of corms per plant (1.63) was noted at T₃ (6% PG) while, the minimum number of corms per plant (1.06) at T₀ and the maximum number of corms per plant (2.06) was observed at T₆ (6% PG + 5% VM) while, the minimum number of corms per plant (1.06) at T₀.
- The maximum number of corms per square meter (13.66) was observed in the treatment T₃ (6% PG) while, the minimum corms per square meter (10.33) at T₀ and the maximum number of corms per square meter (16.33) at T₆ (6% PG + 5% VM) while, the minimum number of corms per square meter (10.33) at T₀.
- The maximum number of cormels per plant (71.59) was showed in the treatment T₃ (6% PG) while, the minimum cormels per plant (49.66) at T₀ and the maximum number of cormels per plant (88.80) was recorded at T₆ (6% PG + 5% VM) while, the minimum number of cormels (49.66) at T₀.
- The maximum number of cormels per square meter (736.66) was showed in the treatment T₃ (6% PG) while, the minimum cormels per square meter (628.66) at T₀ and the maximum number of cormels per square meter (803.33) was recorded at T₆ (6% PG + 5% VM) while, the minimum number of cormels per square meter (628.66) was recorded at T₀.
- The largest diameter of corm (4.76 cm) was noted at T₃ (6% PG) and smallest diameter of corm (3.67 cm) was noted at T₀ and the largest diameter of corm (5.56 cm) was noted at T₆ (6% PG + 5% VM) and smallest diameter of corm (3.67 cm) was noted at T₀.
- The maximum weight of corm (55.53 g) was observed in the treatment T₃ (6% PG) while, the minimum weight of corm (41.61 g) at T₀ and the maximum weight of corm (62.59 g) was recorded at T₆ (6% PG + 5% VM) while, the minimum weight of corm (41.61 g) at T₀.
- The maximum weight of cormels per plant (30.15 g) was showed in the treatment T₃ (6% PG) while, the minimum weight of cormels per plant (20.90 g) at T₀ and the maximum weight of cormels per plant (38.83) was recorded at T₆ (6% PG + 5% VM) while, the minimum weight of cormels per plant (20.90 g) at T₀.

- The maximum number of florets per spike (13.93) was showed in the treatment T₃ (6% PG) while, the minimum number of florets per spike (9.46) at T₀ and the maximum number of florets per spike (15.96) was recorded at T₆ (6% PG + 5% VM) while, the minimum number of florets per spike (9.46) at T₀.
- The maximum spike girth (0.30 cm²) was noted in the treatment T₃ (6% PG) while, the minimum spike girth (0.15 cm²) at T₀ and the maximum spike girth (0.37 cm²) was recorded at T₆ (6% PG + 5% VM) while, the minimum spike girth (0.15 cm²) at T₀.
- The highest spike length (62.21 cm) was showed in the treatment T₃ (6% PG) while, the lowest spike length (45.65 cm) at T₀ and the highest spike length (69.16 cm) was showed in the treatment T₆ (6% PG + 5% VM) while, the lowest spike length (45.65 cm) recorded under T₀.
- The maximum rachis length (37.33 cm) was showed in the treatment T₃ (6% PG) while, the minimum rachis length (29.06 cm) T₀ and the maximum rachis length (43.13 cm) was recorded at T₆ (6% PG + 5% VM) while, the minimum spike length (29.06 cm) at T₀.
- The maximum floret diameter (7.42 cm) was noted in the treatment T₃ (6% PG) while, the minimum floret diameter (5.23 cm) at T₀ and the maximum floret diameter (9.30 cm) was recorded at T₆ (6% PG + 5% VM) while, the minimum floret diameter (5.23 cm) at T₀.
- The maximum vase life of spikes (15.66 days) was showed in the treatment T₁ (2% PG) while, the minimum vase life of spikes (9.00 days) at T₀ and the maximum vase life of spikes (11.33 days) was recorded at T₄ (2% PG + 5% VM) while, the minimum vase life of spikes (9.00 days) at T₀.

CONCLUSION

On the basis of finding of the present experiment the following conclusion may be drawn. Among the 8 treatments the treatment combination T₆ (6% PG + 5% VM) resulted in the maximum plant height (103.33 cm), highest number of leaves per plant (10.26), maximum leaf length (54.44 cm), maximum leaf width (5.36 cm), maximum main collar diameter (3.15 cm), highest number of spikes per plant (2.10), highest number of spikes per square meter (16.27), maximum number of corms per plant (2.06), maximum number of corms per square meter (16.66), highest number of cormels per plant (88.80), maximum number of cormels per square meter (803.33), maximum diameter of corm (5.56 cm), maximum weight of corm (62.59 g), maximum weight of cormels per plant (38.83 g), maximum number of florets per spike (15.96), maximum spike girth (0.37 cm²), maximum spike length (69.16 cm), maximum rachis length (43.13 cm), highest floret diameter (9.30 cm).

The highest net return of Rs.1239116 and Benefit: Cost ratio (2.81) was recorded in treatment T₆ (6% PG + 5% VM) as compared to control T₀ (1.37) Table (4.11).

CHAPTER -7

LITERATURE CITED

- Anonymous. (2016). Agriculture and Processed Food Products Export Development Authority (APEAD). Agri Exchange DGCIS Annual report.
- Anonymous. (2015). Indian Horticulture Database. National Horticulture Board, Gurgaon. 118-121.
- Anonymous. (2017). Indian Horticulture Database. National Horticulture Board, Gurgaon. Annual report.
- Ansari, A.A., (2008). Effect of Vermicompost and Vermiwash on the Productivity of Spinach (*Spinacia oleracea*), Onion (*Allium cepa*) and Potato (*Solanum tuberosum*). *World Journal of Agricultural Sciences*, **4**(5): 554-557.
- Ansari, A.A. and Kumar, S. (2010). Effect of Vermiwash and Vermicompost on soil parameters and productivity of okra (*Abelmoschus esculentus*) in Guyana, *African Journal of Agriculture Research*, **5**(14): 1794-1798.
- Anburani, A. and Vidhyapriyadharshini, H. (2012). Response of growth attributes on mulia (*Jasminum auriculatum*) organic and inorganic nutrients. *Journal of Ornamental Horticulture*, **11**(3): 212-215
- Anuradha, K., Pampavathy, K. and Narayana, N. (1990). Effect of nitrogen and phosphorus on flowering, yield and quality of marigold. *Indian Journal of Horticulture*, **47**(3): 35-357.
- Baskaran, V., Abirami, K. and Roy, S.D. (2014). Effect of plant growth regulators on yield and quality in gladiolus under Bay Island condition. *Journal of Horticulture Science*, **9**(2): 213-216.
- Bellubbi, S.B., Kulkarni, B.S. and Patil, C. (2015). Effect of integrated nutrient management on growth and flowering of gerbera (*Gerbera jamesonii* L.) var. Rosalin under naturally ventilated polyhouse condition. *International Journal of Agriculture Science and Veterinary Medicine*, **1**(1): 69-74.
- Bhalla, R., Kanwar P., Dhiman, S. R. and Jain, R. (2006). Effect of bio fertilizers and biostimulants on growth and flowering in gladiolus. *Journal of Ornamental Horticulture*, **9**(4): 248-252.
- Black, C. A. 1965. Methods of soil Analysis. Vol. 1, *American Society of Agronomy*, Magisin, Wisconsin, USA.

- Bouyoucos, G.J. (1927). The hydrometer as a new method for the mechanical analysis of soil.
- Chakraborty, D.S., Sadhukhan, R. and Dey, S. (2009). Integrated nutrient management studies in anthurium. *Journal of Ornamental Horticulture*, **12**(4): 265-268.
- Chattopadhyay, A. (2014). Effect of Vermiwash and Vermicompost on an Ornamental Flower, *Zinnia sp.* *Journal of Horticulture*, **1**(3): 45-50.
- Cook, A.G., Critchley, B.R. and Critchley, U. (1980). Effect of cultivation and DDT on earth worm activity in a forest Soil in the Sub- humid tropics. *Journal Applied Ecology*, **17**: 21-29.
- Dharma, S. (2006). Effect of bio fertilizers and biostimulants on growth and flowering of carnation (*Dianthus caryophyllus* L) cv. 'Sunrise'. Ph.D. Thesis, Dr Y S Parmar University of Horticulture and Forestry, Nauni, Solan (H.P.), India, 124.
- Djanaguiraman, M.P., ManicKasundaram and Chinnasamy, C. (2005). Effect of various Bioregulator on fruit set and yield of tomato cv. PKM. *Indian journal Agriculture Resource Management*, **4**(1):249 - 250.
- Elumalai, D., Kaleena, P.K., Fathima, M. and Hemavathi. (2013). Influence of vermiwash and plant growth regulators on the exomorphological characters of *Abelmoschus esculentus* (Linn.) Moench. *African Journal of Basic Applied Sciences*, **5**(2): 82-90.
- Gurav, S.B., Singh, B.R., Kakaije, D.S., Patil, M.T. and Ranpise, S.A. (2008). Integrated nutrient Management in gerbera. In Book of abstracts. *National Symposium on recent advances in Floriculture*, **3**(4): 45-48.
- Harshavardhan, M., Kumar, D.P., Sajjan, R., Rajesh, A. M. and Yathindra, H.A. (2014). Influence of INM on flower quality, yield and vase life of carnation (*Dianthus caryophyllus* L.) under polyhouse. *Green Farming*, **6**(3): 435-438.
- Hatti, S.S., Londonkar, R.L., Patil, S.B., Gangawane, A.K. and Patil, C.S. (2010). Effect of *Eisenia fetida* Vermiwash on the growth of plants. *Journal of crop science*, **1**(3): 06-10.
- Issac, S. (2007). Studies on influence of growth regulators and bio – inoculants on breaking dormancy and prolonging viability in gladiolus (*Gladiolus grandiflorus*) seed corm's, M. Sc. (Hort.) Thesis , University of Agriculture Science, Bangalore.

- Jackson, M. L. (1973). Soil Chemical Analysis. Prentice Hall of India Private Limited, New Delhi, India, 183–192.
- Jadhav, M.R. and Roopsingh, G. (2007). Nutritional studies in Anthurium, (*Anthurium andraeanum* L.). *Asian Journal of Horticulture*, **9**(8): 221-226.
- Jahagirdar, S., Ravikumar, M.R. and A.L. Siddaramaiah. (2003). Traditional methods in the management of plant diseases. *Agriculture Review*, **24** (2):142-146.
- Jawaharlal, M., Swapna, C. and Ganga, M. (2012). Comparative analysis of conventional and precision farming systems for African marigold (*Tagetes erecta* L.). *Acta Horticulture*, **970**: 311 - 317.
- Johan, B.A. and Soran, G. (2006). Investigation on the effect of organic and inorganic farming method on black gram and green gram. *Indian Journal Agriculture Research*, **40**(3): 204-207.
- Joshi, A.C., Patel, N.K., Chaudhari, S.R. and Parekh, J.h. (2011). Effect of growth regulators on the growth, flowering, corm and cormel attributes of gladiolus. *Advanced Research Journal of Crop Improvement*, **2**(2): 260-262.
- Karuna, K., Patil, C.R., Narayanswamy, P. and Kale, R.D. (1999). Stimulatory effect of earthworm body fluid (vermiwash) on crinckle red variety of *Anduriumandreanum* Linn, *Crop Research*, **17**(2): 253-257.
- Kathiresan, C. and Venkatesha, J. (2002). Effect of biofertilizers with levels of N and P on gladiolus. In: Floriculture Research Trend in India. Misra, R.L. and Mishra, S. (eds.), Proceedings of the National Symposium on Indian Floriculture in the New Millennium, Lai Bagh, Bangalore, 118-121.
- Kaur, P., Bhardwaj, M. and Babbar, I. (2015). Effect of Vermicompost and Vermiwash on Growth of Vegetables. *Research Journal of Animal, Veterinary and Fishery Sciences*, **3**(4):9-15.
- Khimani, R.A. (1995) A note on self –life studies in gaillardia. *Gujarat Agriculture University Research Journal*, **20**(2): 190-191.
- Kulkarni, B.S., Nalawadi, U.G. and Giraddi R.S. (1996). Effect of vermicompost and vermiculture on growth and yield of China aster. (*Callistiphes chinensis* Nees). cv. Ostrich Plume Mixed. *South Indian Horticulture*, **44**(1 & 2): 33 – 35.
- Kumar, P., Kumar, R. and Kumar, A. (2008). Effect of organic culture on growth, development and post-harvest life of gladiolus (*Gladiolus hybrida*). *Journal of Ornamental Horticulture*, **11**(2): 127- 130.

- Kumar, R., Deka B.S. and Roy, A.R. (2010b). Effect of bioregulators on vegetative growth, flowering and corm production in Gladiolus cv. Candyman. *Journal of Ornamental Horticulture*, **13**(2): 35-40.
- Kumar, R., Dekabidyut, C. and Roy, A.R. (2011). Effect of bioregulators on vegetative growth, flowering and corm production in gladiolus cv. Candyman. *Indian Journal of Horticulture*, **8**(2): 54-56.
- Lourduraj, C., Paulebastian, A.S., Yadav, B.K. and Singaram, P. (2005). Yield attributes and Grain Yield of Rice as influenced by Organic farming practices. *Indian journal Agriculture Resource Management*, **4**(3): 212-213.
- Mahawer, L.N., Bairwa, H.L. and Shukla, A. (2010). Response of bio stimulants as pre harvest management of tuberose cut spike (*Polianthes tuberosa* L.) cv. Phule Rajani. *Progressive Horticulture*, **42**(1): 54-57.
- Maheswari, V. N., Kaleena, P. K., Srikumaran, M. P., Rekha, G. S. and Elumalai, D. (2017). Influence of vermiwash and panchagavya on lablab beans under pot experimental conditions. *International Journal of Advanced Research in Biological Sciences*, **4**(2): 20-27.
- Maheta, P., Polara, N.D. and Rathod, J. (2016). Effect of nitrogen and phosphorus on growth, flowering and flower yield of China aster (*Callistephus chinensis* L. Nees) cv. Poornima. *Asian Journal of Horticulture*, **11**(1): 132-135.
- Metson, A. J. (1956). Method of chemical analysis for soil survey samples. Bull. No. 2, Department of Science, *Natural Resources Soil Bulletin*, 12.
- Nagalakshmi, S., Sankari, A., Anand, M. and Arulmozhiyan, R. (2009). Organic Stimulants on the Growth and Yield of Anthurium (*Anthurium andreanum*) cv. Verdun Red. *Asian Journal of Horticulture*, **5**(3): 450.
- Naidu, K.D., Radder, B.M., Patil, P. L., Hebsur, N.S. and Alagundagi, S.C. (2009). Nutrient uptake and residual fertility of chilli cv. Byadgi Dabbi in a vertisols. *Karnataka Journal of Agriculture Science*, **22**(2): 306-309.
- Naik, S.K., Barman, D., Devadas, R. and Ushabharathi, T. (2013). Evaluation of Panchagavya as source of nutrient for Cymbidium orchids. *African Journal of Agriculture Research*, **8**(46): 5728-5732.
- Natarajan, K., Panchagavya – A manual. Other India Press, Mapusa, Goa, India, (2002). pp. 33.

- Nethra, N.N. (1996). Effect of organic and inorganic fertilizers on growth, yield and post harvest life of china aster (*Callistehus chinensis* L. Nees.). M.Sc. (Hort.) Thesis, University of Agriculture Science, Bangalore.
- Olsen, S. R., Cole, V.C., Watanabe, F.S. and Dean, L.A. (1954). Estimation of available phosphorus in soil by extraction with sodium bicarbonate. Circular United State Department of Agriculture, pp. 939.
- Palagani, N. and Singh, A. (2017). Influence of Bio Fertilizers and Foliar Spray of Spermine and Vermiwash on Growth, Yield and Postharvest Quality of Gerbera (*Gerbera jamesonii* Hook.) Under Naturally Ventilated Polyhouse. *International Journal of Current Microbiology and Applied Sciences*, 6(12): 245-253.
- Panse, V.G. and Sukhatme, P.V. (1985). *Statistical Method for Agriculture Workers*. Indian Council of Agriculture Research Publication, pp. 87-89.
- Pandy, S.N. and Sinha, B.K. (2006). *Plant Physiology*. Vikash Publishing House Pvt Ltd. Noida (UP).
- Papen, H., Gabler, A., Zumbusch, E. and Rennenberg, H. (2002). Chemolithoautotrophic nitrifiers in the phyllosphere of a spruce ecosystem receiving high nitrogen input. *Current Microbiology*, 44: 56-60.
- Patel, V., Patel, G.D., Desai, K.D., Desai, M. and Patel, U. (2017). Integrated nutrient management in African marigold (*Tagetes erecta* L.) *International Journal of Chemical Studies*, 5(4): 1352-1354.
- Pathak, G. and Prabhat, K. (2009). Influence of organics on floral attributes and shelf life of gladiolus (*Gladiolus hybrida*) cv. White Prosperity. *Indian Journals*, 4(1):116-119.
- Patil, M.T. Gurav., S.B. Singh., B.R. Katwate., S.M., Chaudhary, S.M. and Kakade, D.S. (2006). Post-harvest management of tuberose through organic culture. *National symposium on Ornamental Bulbous Crops*, 4(2): 65-68.
- Piper, C. S. (1950). *Soils and plant analysis*. *International Science Publishers Inc.*, New York.
- Pradeep, K., Manivannani, K. and Ramesh, S. (2014). Effect of organic nutrients on growth, flowering and yield of *Gladiolus grandiflorus* L. *The Asian Journal of Horticulture*, 9(2): 416-420.

- Ramachandrudu, K. and Thangam, M. (2008). Performance of gladiolus varieties under agro-climatic conditions of Goa. *Journal of Ornamental Horticulture*, 11(2): 91-97.
- Rameshwar, Chadha, Ashlesha, S., Saini, J.P. and Paul, Y.S. (2012). Vedic krishi: Sustainable livelihood option for small and marginal farmers. *Indian Journal of Traditional Knowledge*, 11(3): 480-486.
- Rawat, V. (2002). Organic all the way. *Agriculture Today*, 6: 55-57.
- Renukaradya, S. (2005). Integrated nutrient management in carnation (*Dianthus caryophyllus* L.) cv. Desio under green house, M. Sc. (Hort) Thesis, University of Agriculture Science, Bangalore.
- Sailaja, V., Naga Ragin, N., Kumar, K.D., Reddy, B.R. and Satyanarayana, S.V. (2014). Effect of foliar application of panchagavya on growth and development of leaf vegetable *Spinacia oleracea*. *International Journal of Agriculture and Food Science*, 10(6): 258-262.
- Samadhiya, H., Dandotiya, P., Chaturvedi, J. and Agrawal, O.P. (2008). Effect of vermiwash on the growth and development of leaves and stem of tomato plant. *International Journal of Current Research*, 5(10): 3020-3023.
- Sankari, A., Anand, M. and Arulmozhiyan, R. (2015). Effect of biostimulants on yield and post harvest quality of gladiolus cv. White Prosperity. *Asian Journal of Horticulture*, 10(1): 86-94.
- Sendhilmathan, R., Karuppaiah, P., Kumar, S.R. (2011). Studies on effect of application of organic nutrients on the growth, flowering and flower quality of *Dendrobium* orchids cv. Sakura Pink. *Advances in Plant Sciences*. 24(2): 609-612.
- Sharma, M.K. (2002). Effect of nitrogen levels and planting dates on growth, yield and quality of gaillardia (*Gaillardia pulchella* Fougier) cv. Yellow Double. *Asian Journal of Horticulture*, 1(6): 116-119.
- Sharma, B.P., Gautam, A., Gupta, Y.C., Dhiman, S. R. and Bhalla, R. (2011). Effect of foliar sprays of biostimulants on growth and flowering of carnation cv. Sunrise. *Journal of Ornamental Horticulture*, 13(2): 101-106.
- Siddappa, R. and Hegde, N.K. (2011). Effect of foliar spray of vermiwash and nutritional treatments on growth and yield performance of curry leaf var. Suvasini. *The Asian Journal of Horticulture*, 6(1): 68-70.
- Singatkar, S.S., Sawant, R.B., Ranpise, S.A. and Wavhal, K.N. (1995). Effect of different levels of N, P and K on growth and flower production of *Gaillardia*. *Journal of Maharashtra Agriculture Universities*, 20(3): 392-394.

- Singh, A.K. (2006). Flower crop cultivation and management. New Indian Publishing Agency. Pitampuram, New Delhi.
- Singh, B., Srivastava, R. and Chandra, R. (2007). Response of panchgavya and manchurian mushroom tea on floral characters in tuberose (*Polianthes tuberosa* L.) cv. Pearl Double. *Journal of Ornamental Horticulture*, 10(4): 250-254.
- Sivasubramanian, K. and Ganeshkumar, M. (2004). Influence of vermiwash on the biological productivity of marigold. *Madras Agricultural Journal*, 6(4): 221-225.
- Somasundaram, E., Sankaran, N., Meena, S., Thiyagarajan, T.M., Chandragiri, K.K. and Panneerselvam, S. (2003). Response of green gram to varied concentrations of panchagavya (organic nutrition) foliar application. *Madras Agricultural Journal*, 90(1-3): 169-172.
- Somasundaram, E., Sankaran, N., Meena, S., Thiyagarajan, T.M., Chandragiri, K.K. (2004). Biogas slurry and panchagavya promising organics to reconstruct our agro ecosystem. *Agro bios Newsletter*, 2(10): 13-14.
- Subhiah, B. V. and Asija, G. L. (1956). A rapid procedure for estimation of available nitrogen in soils. *Current Science*, 25: 259-260.
- Suchitra., Rakesh., Poonguzhali, S., Saranya, B., Suguna, S. and Jothibas, K. (2017). Effect of Panchagavya on Growth and Yield of *Abelmoschus esculentus* cv. Arka Anamika. *International Journal of Current Microbiology and Applied Science*, 6(2): 3090-3097.
- Suguna, M. (2005). Effect of growth regulators and biostimulants on growth and yield of carnation (*Dianthus caryophyllus* L.) var. Mistral. M.Sc. Thesis, Tamil Nadu Agricultural University, Coimbatore.
- Sundararasu, K. and Jeyasankar, A. (2014). Effect of Vermiwash on Growth and Yield of Brinjal, *solanum melongena* (Eggplant and Aubergine). *Asian Journal of Science and Technology*, 5(3): 171-173.
- Sushma, H.E. Reddy, B.S. Patil, C.P. and Kulkarni, B.S. (2012). Effect of organic and inorganic nutrients on sprouting, growth, flowering and nutrient status in *Heliconia* (*Heliconia* sp.) cv. Golden Torch. *Karnataka journal Agricultural Science.*, 25(3): 370-372.

- Tamrkar, S.K., Singh, P., Kumar, V. and Tirkey, T. (2018). Effect of Gibberellic Acid, Salicylic Acid, Cow Urine and Vermiwash on Corm Production of *Gladiolus* cv. Candyman. *International Journal of Current Microbiology and Applied Sciences*, 6(9): 677-686.
- Thamaraiselvi, S.P., Chezhiyan, N. and Ramar, A. (2002). Studies on the effect of growth regulators, calcium, boron and organics on rose. *South Indian Horticulture*, 50(4 - 6): 430 – 436.
- Thangavel, P., Balagurunathan, R., Divakaran, J. and Prabakaran, J. (2003). Effect of vermiwash and vermicast extract on soil nutrients, growth and yield of paddy. *Advance Plant Science*, 6(2): 187-190.
- Tosar, M.V. (1989). Effect of spacing with different levels of nitrogen on growth and flower production of *gaillardia* (*Gaillardia pulchella*). M.Sc. (Agri.) thesis, Gujarat Agricultural University, Sardarkrushinagar, pp 12-13.
- Vasumathi, R. (2001). Influence of organic manures, bio fertilizer and plant density on growth, yield and alkaloid content of *Bhumyamalaki* (*Phyllanthus*). M.Sc., (Hort). Thesis, Tamil Nadu Agricultural University, Coimbatore.
- Venkataramana, P., Murthy, B., Narasimha, R., Krishna, J.V. and Kamble, C.K. (2009). Efficacy of foliar sprays of vermiwash and cow dung wash on biochemical and yield attributes and yield of mulberry (*Morus alba* L.). *Karnataka Journal Agricultural Science*, 22(4): 921-923.
- Vennila, C. and Jayanthi, C. (2010). Effect of inorganic nutrients and organic foliar spray on growth and yield of okra. *Progressive Horticulture*, 42(1): 94-96.
- Vidhya, P.H. and Anburan, A. (2007). Nutritional Studies on Flowering and Yield Parameters in Mullai (*Jasminum auriculatum*). *Journal of Ornamental Horticulture*, 10(2): 85-90.
- Vimalendran L. and Wahab, K. (2013). Effect of Foliar Spray of Panchagavya on Yield Attributes, yield and Economics of Babycorn. *Journal of Agronomy*, 12(2): 109-112.
- Waheeduzzama, M., Jawaharalal, M., Arullmohiyar, R. and Indumathik, K. (2007). Integrated nutrient management practices to improve flower yield in anthurium, (*Anthurium andreanum* Lind.). *Journal of Ornamental Horticulture*, 10(1): 42-45.
- Walkey, A. J. and Black, J. A. (1934). Rapid titration method for organic carbon, *Soil Science*, 37: 29-33.

Xu, H. (2000). Effects of microbial inoculants and organic fertilizers in the growth, photosynthesis and yield of sweet corn. *Journal of Crop Production*, 3: 235-243.

Yathisha, S.M. (2008). Influence of organic on growth, flower yield and quality of tuberose (*Polianthes tuberosa* L.) cv. Srinagar. M. Sc. (Hort) Thesis, University of Agriculture Science, Bangalore.

Yuvaraj,T. (2007). Effect of organic inputs and standardization of postharvest techniques in *Wedelia chinensis*. M.Sc. (Hort.) Thesis, Tamil nadu Agriculture University, Coimbatore.

Effect of panchagavya and vermiwash on vegetative growth, yield and quality of *Gladiolus (Gladiolus hybridus Hort.)* cv. Gunjan.

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ABSTRACT

A field experiment entitled “**Effect of panchagavya and vermiwash on vegetative growth, yield and quality of *Gladiolus (Gladiolus hybridus Hort.)* cv. Gunjan**” was conducted during Rabi *season*, 2018-19 at the Department of Floriculture and Landscaping, College of Horticulture and Forestry, Jhalawar, Rajasthan. The experiment consist of 8 treatment having two organic product *viz.* Panchagavya and Vermiwash each at 2 levels (Foliar spray of sole concentration and Combined concentration) and laid out in Randomized Block Design with three replication.

Among the sole application of panchagavya and vermiwash treatment T₃ (6% PG) resulted in the maximum plant height (93.37 cm), maximum number of leaves per plant (9.26), maximum leaf length (48.32 cm), maximum leaf width (4.71 cm), maximum main collar diameter (2.42 cm), maximum number of spikes per plant (1.60), maximum number of spikes per square meter (13.93), highest number of corms per plant (1.63), highest number of corms per square meter (13.66), maximum number of cormels per plant (71.59), maximum number of cormels per square meter (736.66), maximum diameter of corm (4.76 cm), maximum weight of corm (55.33 g), highest weight of cormels per plant (30.15 g), maximum number of florets per spike (13.93), maximum spike girth (0.30 cm²), maximum spike length (62.21 cm), maximum rachis length (37.33 cm) and maximum floret diameter (7.42 cm). The maximum vase life of spikes (15.66 days) was recorded with treatment T₁ (2% PG).

The foliar spray of combined concentration of panchagavya and vermiwash treatment T₆ (6% PG + 5% VM) resulted in the maximum plant height (103.33 cm), maximum number of leaves per plant (10.26), maximum leaf length (54.44 cm), maximum leaf width (5.36 cm), maximum main collar diameter (3.15 cm), maximum number of spikes per plant (2.10), maximum number of spikes per square meter (16.27), highest number of corms per plant (2.06), highest number of corms per square meter (16.66), maximum number of cormels per plant (88.80), maximum number of cormels

per square meter (803.33), maximum diameter of corm (5.56 cm), maximum weight of corm (62.59 g), highest weight of cormels per plant (38.83 g), maximum number of florets of spike (15.96), maximum spike girth (0.37 cm²), maximum spike length (69.16 cm), maximum rachis length (43.13 cm) and maximum floret diameter (9.30 cm). The maximum vase life (11.33 days) of spikes was recorded with treatment T₄ (2% PG + 5% VM).

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ग्लेडियोलस (ग्लेडियोलस हाइब्रीडस होर्ट.) किस्म गुंजन की वानस्पतिक बढ़वार,
उपज एवं गुणवत्ता पर पंचगव्य और वर्मीवॉश का प्रभाव

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सारांश

उधानिकी एवं वानिकी महाविद्यालय झालरापाटन, झालावाड़ के पुष्प एवं भूदृश्य विज्ञान विभागान्तर्गत निर्देशन प्रक्षेत्र पर ग्लेडियोलस (ग्लेडियोलस हाइब्रीडस होर्ट.) किस्म गुंजन की वानस्पतिक बढ़वार, उपज एवं गुणवत्ता पर पंचगव्य और वर्मीवॉश का प्रभाव नामक एक प्रेक्षण वर्ष 2018-19 कि रबी ऋतु में किया गया। इस प्रयोग में दो कार्बनिक उत्पाद पंचगव्य और वर्मीवॉश की दो सान्द्रता (एकल सान्द्रता एवं मिश्रित सान्द्रता से पर्ण छिड़काव) में 8 उपचार संयोजनों का यादृच्छित खण्ड अभिकल्पना में तीन पुनरावृत्तियों के साथ किया गया।

एकल सान्द्रता के पंचगव्य एवं वर्मीवॉश का पर्ण छिड़काव उपचार T₃ (6% PG) में अधिकतम पौधे की ऊंचाई (93.37 सेमी), पत्तियों की संख्या प्रति पौधा (9.26), पत्ती की लम्बाई (48.32 सेमी), पत्ती की चौड़ाई (4.71 सेमी), तने का व्यास (2.42 सेमी), प्रति पौधा पुष्पक दण्डिकाओं की संख्या (1.60), प्रति वर्गमीटर पुष्पक दण्डिकाओं की संख्या (13.93), प्रति पौधा घनकंदों की संख्या (1.63), प्रति वर्गमीटर घनकंदों की संख्या (13.66), प्रति पौधा घनकंदों की संख्या (71.59), प्रति वर्गमीटर लघु घनकंदों की संख्या (736.33), घनकंद का व्यास (4.76 सेमी), घनकंद का भार (55.33 ग्राम), प्रति पौधा लघु घनकंदों का भार (30.15 ग्राम), प्रति पुष्पक दण्डिका पुष्पको की संख्या (13.93), पुष्पक दण्डिका की परिधि (0.30 वर्गसेमी), पुष्पक दण्डिका की लम्बाई (62.21 सेमी), पिच्छाक्ष की लम्बाई (37.33 सेमी), पुष्प का व्यास (7.42 सेमी) और लाभ का लागत अनुपात (2.17) पाया गया। पुष्पक दण्डिका की अधिकतम फूलदान अवधि (15.66 दिन), उपचार T₁ (2% PG) में दर्ज किया गया।

मिश्रित सान्द्रता के पंचगव्य एवं वर्मीवॉश का पर्ण छिड़काव उपचार T₆ में (6% PG+5% VM) में अधिकतम पौधे की ऊंचाई (103.33सेमी), पत्तियों की संख्या प्रति पौधा (10.26), पत्ती की लम्बाई (54.44 सेमी), पत्ती की चौड़ाई (5.36 सेमी), तने का व्यास (3.15 सेमी), प्रति पौधा पुष्पक दण्डिकाओं की संख्या (2.10), प्रति वर्गमीटर पुष्पक दण्डिकाओं की संख्या (16.27), प्रति पौधा घनकंदों की संख्या (2.06), प्रति वर्गमीटर घनकंदों की संख्या (16.66), प्रति पौधा घनकंदों की संख्या (88.80), प्रति वर्गमीटर लघु घनकंदों की संख्या (803.33), घनकंद का व्यास (5.56 सेमी), घनकंद का भार (62.69 ग्राम), प्रति पौधा लघु घनकंदों का भार (38.83 ग्राम), प्रति पुष्पक दण्डिका पुष्पको की संख्या (15.96), पुष्पक दण्डिका की परिधि (0.37 वर्गसेमी), पुष्पक दण्डिका की लम्बाई (69.16 सेमी), पिच्छाक्ष की लम्बाई (43.13 सेमी), पुष्प का व्यास (9.30 सेमी) और लाभ का लागत अनुपात (2.81) पाया गया। पुष्पक दण्डिका की अधिकतम फूलदान अवधि (11.33 दिन), उपचार T₄ (2% PG+5% VM) में दर्ज किया गया।

* स्नातकोत्तर विद्यार्थी, पुष्प एवं भूदृश्य विज्ञान विभाग, उधानिकी एवं वानिकी महाविद्यालय झालरापाटन, झालावाड़ (राज.)

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APPENDIX – I

Analysis of variance for effect of panchagavya and vermiwash on plant height (cm)

Source of Variation	D.F	S.S	M.S	F.Cal	F.Tab 5%
Replication	2	9.1476	4.5738	0.2	3.73
Treatment	7	1788.614	255.516	10.9*	2.76
Error	14	328.264	23.447		
Total	23	2126.026			

*Significant at 5 per cent level of significance

APPENDIX – II

Analysis of variance for effect of panchagavya and vermiwash on number of leaves per plant

Source of Variation	D.F	S.S	M.S	F.Cal	F.Tab 5%
Replication	2	0.655	0.327	1.34	3.738
Treatment	7	22.7	3.2428	13.21*	2.764
Error	14	3.437	0.245		
Total	23	26.793			

*Significant at 5 per cent level of significance

APPENDIX – III

Analysis of variance for influence of panchagavya and vermiwash on leaf length (cm)

Source of Variation	D.F	S.S	M.S	F.Cal	F.Tab 5%
Replication	2	11.685	5.842	0.96	
Treatment	7	755.696	107.956	17.66*	2.76
Error	14	85.590	6.113		
Total	23	852.971			

*Significant at 5 per cent level of significance

APPENDIX – IV

Analysis of variance for effect of panchagavya and vermiwash on leaf width (cm)

Source of Variation	D.F	S.S	M.S	F.Cal	F.Tab 5%
Replication	2	0.0711	0.035	0.48	
Treatment	7	13.858	1.9797	26.88*	2.76
Error	14	1.031	0.073		
Total	23	14.960			

*Significant at 5 per cent level of significance

APPENDIX – V

Analysis of variance for effect of panchagavya and vermiwash on main collar diameter
(cm)

Source of Variation	D.F	S.S	M.S	F.Cal	F.Tab 5%
Replication	2	0.068	0.034	0.94	
Treatment	7	5.281	0.754	20.85*	2.76
Error	14	0.506	0.036		
Total	23	5.855			

*Significant at 5 per cent level of significance

APPENDIX – VI

Analysis of variance for effect of panchagavya and vermiwash on days to spike
emergence

Source of Variation	D.F	S.S	M.S	F.Cal	F.Tab 5%
Replication	2	26.13	13.065	3.11	
Treatment	7	77.131	11.018	2.63*	2.76
Error	14	58.723	4.194		
Total	23	161.985			

*Significant at 5 per cent level of significance

APPENDIX – VII

Analysis of variance for effect of panchagavya and vermiwash on days to first floret opening from spike emergence

Source of Variation	D.F	S.S	M.S	F.Cal	F.Tab 5%
Replication	2	0.853	0.426	1.09	
Treatment	7	5.118	0.731	1.87	2.76
Error	14	5.466	0.390		
Total	23	11.438			

*Significant at 5 per cent level of significance

APPENDIX – VIII

Analysis of variance for effect of panchagavya and vermiwash on number of spikes per plant

Source of Variation	D.F	S.S	M.S	F.Cal	F.Tab 5%
Replication	2	0.008	0.004	0.43	
Treatment	7	3.477	0.496	52.08*	2.76
Error	14	0.133	0.009		
Total	23	3.6190625			

*Significant at 5 per cent level of significance

APPENDIX – IX

Analysis of variance for effect of panchagavya and vermiwash on number of spikes per square meter

Source of Variation	D.F	S.S	M.S	F.Cal	F.Tab 5%
Replication	2	0.954	0.477	0.99	
Treatment	7	127.588	18.226	37.83*	2.76
Error	14	6.745	0.481		
Total	23	135.288			

*Significant at 5 per cent level of significance

APPENDIX – X

Analysis of variance for effect of panchagavya and vermiwash on number of corms per plant

Source of Variation	D.F	S.S	M.S	F.Cal	F.Tab 5%
Replication	2	0.040	0.020	0.98	
Treatment	7	2.286	0.326	15.63*	2.76
Error	14	0.292	0.020		
Total	23	2.619			

*Significant at 5 per cent level of significance

APPENDIX – XI

Analysis of variance for effect of panchagavya and vermiwash on number of corms per square meter

Source of Variation	D.F	S.S	M.S	F.Cal	F.Tab 5%
Replication	2	2.084	1.0421	0.7	
Treatment	7	111.803	15.971	10.67*	2.76
Error	14	20.963246 62	1.4973		
Total	23	134.851			

*Significant at 5 per cent level of significance

APPENDIX – XII

Analysis of variance for effect of panchagavya and vermiwash on number of cormels per plant

Source of Variation	D.F	S.S	M.S	F.Cal	F.Tab 5%
Replication	2	25.584	12.792	0.83	
Treatment	7	3582.885	511.840	33.13*	2.76
Error	14	216.263	15.447		
Total	23	3824.7336 96			

*Significant at 5 per cent level of significance

APPENDIX – XIII

Analysis of variance for effect of panchagavya and vermiwash on number of cormels per square meter

Source of Variation	D.F	S.S	M.S	F.Cal	F.Tab 5%
Replication	2	1554.333	777.166	0.56	
Treatment	7	73425.333	10489.333	7.52*	2.76
Error	14	19537.666	1395.547		
Total	23	94517.333			

*Significant at 5 per cent level of significance

APPENDIX – XIV

Analysis of variance for effect of panchagavya and vermiwash on diameter of corm (cm)

Source of Variation	D.F	S.S	M.S	F.Cal	F.Tab 5%
Replication	2	0.134	0.067	0.65	
Treatment	7	9.719	1.388	13.39*	2.76
Error	14	1.452	0.103		
Total	23	11.30655 374			

*Significant at 5 per cent level of significance

APPENDIX – XV

Analysis of variance for effect of panchagavya and vermiwash on weight of corm (g)

Source of Variation	D.F	S.S	M.S	F.Cal	F.Tab 5%
Replication	2	23.935	11.967	1.09	
Treatment	7	855.951	122.278	11.17*	2.76
Error	14	153.235	10.945		
Total	23	1033.1223			

*Significant at 5 per cent level of significance

APPENDIX –XVI

Analysis of variance for effect of panchagavya and vermiwash on weight of cormels per plant

Source of Variation	D.F	S.S	M.S	F.Cal	F.Tab 5%
Replication	2	2.014	1.007	0.44	
Treatment	7	873.678	124.811	54.07*	2.76
Error	14	32.318	2.3084388 16		
Total	23	908.011			

*Significant at 5 per cent level of significance

APPENDIX –XVII

Analysis of variance for effect of panchagavya and vermiwash on number of florets per spike

Source of Variation	D.F	S.S	M.S	F.Cal	F.Tab 5%
Replication	2	2.155	1.077	1.4	
Treatment	7	117.536	16.790	21.77*	2.76
Error	14	10.797	0.771		
Total	23	130.489			

*Significant at 5 per cent level of significance

APPENDIX –XVIII

Analysis of variance for effect of panchagavya and vermiwash on spike girth (cm²)

Source of Variation	D.F	S.S	M.S	F.Cal	F.Tab 5%
Replication	2	0.000	0.000	1.22	
Treatment	7	0.136	0.019	104.6*	2.76
Error	14	0.002	0.000		
Total	23	0.139			

*Significant at 5 per cent level of significance

APPENDIX –XIX

Analysis of variance for effect of panchagavya and vermiwash on spike length (cm)

Source of Variation	D.F	S.S	M.S	F.Cal	F.Tab 5%
Replication	2	25.260	12.630	1.09	
Treatment	7	1519.527	217.075	18.67	2.76
Error	14	162.807	11.629		
Total	23	1707.5945			

*Significant at 5 per cent level of significance

APPENDIX –XX

Analysis of variance for effect of panchagavya and vermiwash on rachis length (cm)

Source of Variation	D.F	S.S	M.S	F.Cal	F.Tab 5%
Replication	2	7.199	3.599	0.95	
Treatment	7	537.678	76.811	20.31*	2.76
Error	14	52.951	3.782		
Total	23	597.829			

*Significant at 5 per cent level of significance

APPENDIX –XXI

Analysis of variance for effect of panchagavya and vermiwash on floret diameter (cm)

Source of Variation	D.F	S.S	M.S	F.Cal	F.Tab 5%
Replication	2	0.153	0.076	0.23	
Treatment	7	45.677	6.525	19.76*	2.76
Error	14	4.622	0.330		
Total	23	50.453			

*Significant at 5 per cent level of significance

APPENDIX –XXII

Analysis of variance for effect of panchagavya and vermiwash on vase life of (days)

Source of Variation	D.F	S.S	M.S	F.Cal	F.Tab 5%
Replication	2	0.174	0.087	2.32	
Treatment	7	111.946	15.992	424.32*	2.76
Error	14	0.527	0.037		
Total	23	112.648			

APPENDIX –XXIII

Analysis of variance for effect of panchagavya and vermiwash on anthocyanin content
(mg/ 100 gm)

Source of Variation	D.F	S.S	M.S	F.Cal	F.Tab 5%
Replication	2	1.1200	0.560	0.7	
Treatment	7	6.392	0.913	1.13*	2.76
Error	14	11.278	0.805		
Total	23	18.790			

APPENDIX – XXVI

S. No.	Particulars variable cost	Units	Rate per unit (Rs.)	Cost ha ⁻¹ (Rs.)
A.	Land preparation charges by tractor			
i.	Ploughing (4)	6 hrs	350 per hour	2100
ii.	Harrowing (2)	2 hrs	350 per hour	700
iii.	Planking (2)	2 hrs	300 per hour	600
iv.	Sub total			3400
B.	Labour charges			
i	Bead formation	15 man days	200	3000
ii	Corm treatment	5 man days	200	1000
iii	Corm cost	83333 corm	4	333332
iv	Corm planting	20 man days	300	6000
v	Irrigation (10)	20 man days	200	4000
vi	Application of manures	10 man days	200	2000
vii	Weeding and hoeing (2)	24 man days	200	4800
viii	Earthing up	20 man days	300	6000
ix	Harvesting and selling of spikes	30 man days	200	6000
x	Corm harvesting	30 man days	350	10500
xi	Miscellaneous	-----	-----	500
	Sub total			371132
C.	Material inputs			
i	Irrigation	8	500	4000
ii	Vermicompost	10 tonnes	1000 tonnes ⁻¹	10000
iii	Packing charge	-----	-----	4800
iv	Transport & marketing charge	-----	-----	10500
	Sub total			29300
D.	Overhead cost			
i	Rental value of land			5000
ii	Interest on working capital			5000
iii	Depreciation cost			600
	Sub total			10600
	Total (A+B+C+D)			414434

Common cost of cultivation ha⁻¹ of the experimental crop

APPENDIX – XXV**Variable cost of treatments ha⁻¹**

Treatments	PG req. for Foliar spray/ha	VM req. for Foliar spray /ha	Total cost per treatment	Common cost ha ⁻¹	Total cost ha ⁻¹
T ₀	0	0	0	414434	414434
T ₁	46.20 liter	0	6900	414434	421334
T ₂	92.50 liter	0	13800	414434	428234
T ₃	138.80 liter	0	20700	414434	435134
T ₄	46.20 liter	115.74 liter	12650	414434	427084
T ₅	92.50 liter	115.74 liter	19550	414434	433984
T ₆	138.80 liter	115.74 liter	26450	414434	440884
T ₇	0	115.74 liter	5750	414434	420184