Effect of NPK levels on growth and yield of late sown winter baby corn (*Zea mays* L.)

काशी हिन्दू विश्वविद्यालय

BANARAS HINDU UNIVERSITY

BHU

capital of knowledge

THESIS

submitted in partial fulfilment of the requirements
for the award to the degree of

Master of Science (Agriculture)

in

Agroforestry

Submitted by

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Through: **The Head,**
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Sir,

I have great pleasure in forwarding the thesis entitled **"Effect of NPK levels on growth and yield of late sown winter baby corn"** submitted by **Ms. Kunjam Hrudaya, Examination Roll 422746, ID No. 19430AGF012,** in partial fulfillment of the requirements for the degree of **Master of Science (Agriculture)** in **Agroforestry,** Institute of Agricultural Sciences, Banaras Hindu University, Varanasi (U.P.) and placing on record that she has completed the requisite residential requirements as contained in the statutes of the university.

I certify that the entire scheme of investigation presented herein was planned and carried out solely by the candidate under my guidance and supervision. The data presented in the thesis, to the best of my knowledge and belief, are genuine and original.

Thanking you,

Yours faithfully

Forwarded by

(S. P. Singh)
Supervisor

Head

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Date:
Place: *Varanasi* ***(Kunjam Hrudaya)***

CONTENTS

ABBREVIATIONS AND SYMBOLS USED

%	Percent	LAI	leaf area index
:	ratio (is to)	mg	milligram
@	at the rate of	mg/g	milligram per gram
√	square root	ml	Millilitre
°C	degree Celsius	mm	Millimetre
ANOVA	Analysis of Variance	MOP	Murate of Potash
APEDA	Agricultural and Processed Food Products Export Development Authority	MSS	Mean Sum of Square
B	Boron	N	nitrogen
CD	critical difference	nm	Nanometre
cm	Centimetre	NS	Non-significant
cm^2	square centimetre	P	phosphorus
d Sm^{-1}	d Seimen per metre	pH	potential of hydrogen
DACNET	Directorate of Economics and Statistics; Department of Agriculture and Farmers Welfare; Ministry of Agriculture and Farmers Welfare	$plant^1$	per plant
DAS	days after sowing	R.G.S.C	Rajiv Gandhi South Campus
day^{-1}	day^{-1}	CBD	Complete Randomised Design
DF	degree of freedom	RDF	recommended dose of fertilizer
DNA	Deoxyribonucleic Acid	RDN	recommended dose of nitrogen
EMSS	Error Mean Sum of Square	RNA	Ribonucleic acid
et al.	et alia (and others)	rpm	revolutions per minute
etc	etcetera (the rest)	S	Sulphur
Fe	Iron	SEm±	standard error of mean
Fig	figure	SPAD	Soil Plant Analysis Development
FYM	Farm Yard Manure	SS	sum of squares
g	gram	SSP	Single Super Phosphate
g cm^{-3}	gram per cubic centimetre	U.P	Uttar Pradesh
g kg^{-1}	gram per kilogram	*viz.*	videlicet (As follows or namely)
i.e.,	that is		
IIMR-ICAR	Indian Institute of Maize Research-Indian Council Agricultural Research		
K	Potassium		
kg ha^{-1}	kilogram per hectare		

LIST OF TABLES

LIST OF FIGURES

Chapter I

INTRODUCTION

Maize (*Zea mays* L.) ranks third behind wheat and rice as a food grain crop. Young maize cobs are consumed as vegetables and are called baby corn. Unfertilized and immature baby cob is collected two to three days after silk emergence. Baby corn as an important vegetable crop attracts number of people preferring it for increasing living standards and change in dietary habits from non-vegetarians to vegetarians. Thailand is the largest producer of baby corn (Wang *et al.,* 2009). Baby corn (100 g) contains 89.1% moisture, 28.0 mg calcium, 86.0 mg phosphorus, and 11.0 mg ascorbic acid, 0.2 grams fat, 1.9 grams protein, 8.2 mg carbohydrate, 0.06 g ash, 28.0 mg calcium (Dass *et al.*, 2008).

Baby corn is one of the India's leading crops cultivated throughout the year (Singh *et al.,* 2015). In domestic and international markets baby corn provides a wide range of processing and export opportunities. An intriguing discovery recently was the cultivation of maize for vegetables (Dass *et al.*, 2008). Thailand and China are now the world leaders in the production of baby corn. Baby corn is grown in India in Meghalaya, West Uttar Pradesh, Haryana, Maharashtra, Karnataka and Andhra Pradesh.

Fries, pickles, pulavs, soups, salads and snacks make baby corn as a fresh vegetable in India. The fiber and phosphorus in baby corn is high. Calories and free cholesterol are minimal in this vegetable. It is rich in nutrients and is an excellent source of low glycogenic index, vitamins and minerals are present as in an ordinary maize. Baby corn is good for blood sugar management. Thus, the nutritious content of baby corn is equivalent to other vegetables. This vegetable is free from pests and illnesses (Pandey *et al*., 2000). It includes important vitamins and minerals that are required for a human.

The general human health includes the essential minerals which include zinc, magnesium, copper, iron, and manganese. It is regarded a good food crop and may be utilized in any stage of growth due to its high succulence, palatability and digestibility (Singh *et al.,* 2006). Its green forage possesses lactogenic characteristics, which is particularly suitable for dairy animals.

For the best growth, baby corn requires excellent sunshine and this crop may be grown all year long. Depending on the availability of the irrigation, baby corn can be seeded any time between January and October. In several ways, baby corn farming techniques differ from maize farming. The baby corn grows in around two months, whereas maize matures in four months. For baby cereal crops, the detasseling activity is an important operation in guaranteeing higher quality (Moreira *et al.,* 2010). In a short amount of time farmers may raise their revenue by growing baby corn. To achieve maximum output, farmers should be made aware of the enhanced growing methods of baby corn.

Crop plant growth and development is linked directly with their genetic makeup but environmental and cultural practices have an impact on numerous metabolic processes of the plants, both directly and indirectly. Therefore, agricultural production is very essential for improving sustainable crop yield as the result having a combined influence of the soil-water-fertilizer-climate continuum, which necessitates a methodical and scientific approach to this complicated system. Among the inputs, mineral plant nutrition is the most important input to make a contribution to crop efficiency since the output of food grain in the previous two decades has increased by 55%. Total yearly removal by crop and agricultural system of nutrients, however, was significantly more than the quantity provided by fertilizers and led to the adverse nutrient balance of the soil. Therefore it is necessary to make quick efforts, not only to raise and stabilize crop output, but also to improve the efficiency of fertilizer usage.

However, one of the essential aspects in achieving the greatest production of baby corn is the importance of balanced and appropriate nourishment. Nutrients also play an important role in order to achieve efficient development of crop ontogeny, crop production and enhance crop quality. In addition, N, P and K are key ingredients in the continuous production and improvement of the quality of baby corn.

Nitrogen (N) is a key element in maize productivity and a key determinant (Shanti *et al.,* 1997). Nitrogen is a protein and nuclear acid component and growth is decreased when N is inadequate. The availability of nitrogen is necessary for optimal maize development in adequate amounts during the growing season (Haque *et al.,* 2001). As a significant cell ingredient, nitrogen plays a critical function in cell division as a key element of several metabolic chemicals. This is therefore a fundamental part of every live cell's function. Increasing nitrogen availability at larger dosages of fertilizers might thus contribute to better protein synthesis and photosynthesis resulting in fast cell division and extension that eventually leads to strong plant growth. The second critical ingredient for better maize production is phosphorus. The lack of phosphorus is therefore just as critical as the lack of nitrogen (Gul *et al.,* 2015). Nitrogen is one of the main nutrients required for the formation of baby corn. It plays a crucial part in cellular growth and development, as it is structural element of amino acids, protein molecules, enzymes, alkaloids, nuclear products, chlorophyll and other components.

The primary issue limiting baby corn's economic output is N deficiency. N is also a frequent issue in cereals when applied. Efficient usage reduces nitrate leaching to groundwater and improves the nitrogen use efficiency (NUE). Keeping a diagnosis of insufficient nutrients, measurement of precise dosages and increased efficiencies in nutrient usage are key interventions for the successful management of a soil's nutrient. The baby corn is a new crop, thus the study in India is very less. Agronomic management of baby corn is different from grain maize due to its shorter harvesting life and its focus in producing more baby cobs early harvesting. Specific cultivars, spacing, crop density and use of fertilizer to realize greater productivity.

Appropriate N supply is very crucial. Optimized agricultural yields depend on major yield development variables, such as genotype, optimal plant population particular location and plant nutrition.

As an ADP and ATP component, phosphorus is a vital part of the transformation of energy. It also helps to assimilate photosynthesis into other metabolites and hence functions as an active area for the absorption of CO2. This is crucial for the development and ripening of seeds and fruit. Phosphorus accelerates fruit ripening, therefore counteracting the impact of increased soil nitrogen application. It also promotes cell division and is essential for meristematic development, being an important component of chromosomes. Appropriate phosphorus input therefore enables the plant to develop quickly.

Potassium is also the most important nutrient of all plants and the most abundant cation. It has an important function in activation of enzymes, protein synthesis, photosynthesis, osmoregulation, stomach motility and energy transfer, transport of organic nutrients through phloem, cation and unpaired electron balance and stress resistance (Gul *et al.,* 2015). With such a plentiful and well-balanced supply of nitrogen, phosphorus, and potassium to baby corn cultivation at 125% RDF, the availability of these foods might have increased, which eventually led to increased plant development (Kumar *et al.,* 2013) (Kumar and Bohra, 2014) (Kumar *et al.,* 2015). In energy transformations, the components of sugar, phosphates, ADP and ATP play a significant role and is also involved in fundamental photosynthesis processes.

Potassium boosts a variety of enzymes, including those involved in carbohydrate metabolism and disease resistance, as well as those engaged in environmental adverse conditions. It also improves nitrogen and phosphorus use and contributes significantly in plant growth and development. Potassium present in the cytoplasm widely controls the osmotic potential of the glycophytic plant cells and tissues (Marschner *et al*., 1995).

Total yearly loss of nutrients from crops and cultivation systems is significantly more than the quantity of fertilizers supplied that has led to an adverse soil nutrient balance which decreases the soil productivity. One major aspect in achieving the highest production of baby corn is the function of balanced and appropriate feeding.

As a sufficient and appropriate supply of nitrogen, phosphorous and potassium to baby corn, these nutrients are more widely available, which can lead to increased plant development (Kumar *et al*., 2015). To assess the influence of the previously listed circumstances, an inquiry entitled **"Effect of NPK levels on growth and yield of late sown winter baby corn (***Zea mays* L.**)"** was undertaken at RGSC, Barkachha, Banaras Hindu University, Mirzapur with following objectives:

Objectives

1. To study the effect of NPK levels on growth of late sown winter baby corn.
2. To study the effect of treatments on yield attributes and yield of late sown winter baby corn.

Chapter II

REVIEW OF LITERATURE

An attempt has been made in this chapter to review the literature available in the country and abroad concerning **"Effect of NPK levels on growth and yield of late sown winter baby corn (***Zea mays* L.**)"** has been presented in a logical manner under several headings.

Baby maize is a dehusked maize cob that has been harvested unfertilized with silk emergence about 2-3 cm long (Pandey *et al.,* 1998). This crop is used as vegetable in various dishes and also preserved after canning. The crispy baby corn posse's high nutrition *i.e.* 0.2 g fat, 2 g protein, 8.2 g carbohydrates, 0.86 mg phosphorous, 0.28 mg calcium, 0.11 mg iron, 11 mg ascorbic acid, 0.08 mg riboflavin, 0.05 mg thiamin 100 g^{-1} of baby corn. It is considered safe for consumption since protected by several layers of husk (Singh *et al.,* 1999) and (Pandey *et al.,* 1998).

2.1 Role of NPK

Maize requires more quantities of nitrogen, phosphorous and potassium being an exhaustive crop. Baby corn needs sufficient N, P & K supply since grown with high plant population and extra short duration (Kumar *et al.,* 2000). Intensive cropping system has resulted poor quality of soil due to deterioration in soil properties ultimately lead to poor crop response to added fertilizers (Harrish and Benzdick, 1991). High nutrient removal by cropping systems reversing nutrient balances to negative (Singh *et al.,* 2002). The imbalance fertilization of primary nutrients caused reduced availability of micro and secondary nutrients in the soil (Larson and Pierce, 1994).

The importance of primary nutrients *viz.* nitrogen, phosphorous and potassium and their role in crop production is well recognized. Nitrogen is a constituent component in several compounds most vital nutrient element and performs as a of many organic *viz.* nucleic acid, amino acid, proteins, protoplasm, nucleotides, enzymes, hormones, vitamins etc. Use of nitrogen also augment the uptake of phosphorous and potassium. Nitrogen leads taller plant, succulence, prolonged harvesting period and better quality of baby corn and fodder (Singh *et al.*, 1998). Phosphorous is involved in the metabolic processes, energy transfer, transformation of sugar and starch, photosynthesis, and movement of nutrients in plants. Phosphorus affects leaf area index, dry matter production and leads heavier cob and ultimately more cob yield and greater returns (Barry and Millar, 1989). Potassium regulates many enzymes which are actively involved in carbohydrate synthesis. Potassium imparts resistance to disease and regulates stomata opening under adverse conditions.

2.2 Effect of NPK levels on growth and growth parameters

Kalpana and Krishnarajan (2002) studied that when 50 kg K ha^{-1} was applied to baby corn, plant height, LAI, and dry matter production were all considerably greater than when 40 kg K ha^{-1} was applied.

Khan *et al.* (2005) the impact of different quantities of P_2O_5 on maize cv. M-6240 was investigated, and it was discovered that maize treated with 100 kg P_2O_5 ha^{-1} produced the best results. Had the highest plant height compared to maize treated with 75 kg P_2O_5 ha^{-1}.

Bakht *et al.* (2006) the effect of nitrogen levels on maize growth indicated that 200 kg N ha^{-1} treatment resulted in considerably taller plants, leaves $plant^{-1}$, and longer days to 50 percent tasseling and silking than 80 kg N ha^{-1}, 120 kg N ha^{-1}, 160 kg N ha^{-1} and control.

Xie *et al.* (2006) researching in Habei Province on a summer corn experiment with three nitrogen (N) levels (control, 90 kg ha^{-1} and 180 kg ha^{-1}) revealed that the leaf area index and chlorophyll content rose as the nitrogen application rate climbed. Similarly, increasing nitrogen treatment up to 180 kg N ha^{-1} the resulted in increased plant height, leaf area index and dry matter production in maize.

Asif *et al*. (2007) the phenology and leaf area of spring maize cv. Azam were studied in response to various potassium levels. (control, 30 kg ha^{-1}, 60 kg ha^{-1} and 90 kg ha^{-1}) when potassium treatment was raised up to 60 kg ha^{-1}, tasseling, silking, and physiological maturity were delayed, but tasseling, silking, and maturity, as well as flag leaf area and leaf area, were considerably boosted when potassium application was increased up to 90 kg ha^{-1}.

Jan *et al*. (2007) observed that, with increasing nitrogen levels from 180 to 300 kg nitrogen ha^{-1}, for plant height, hybrid maize responded favorably to treatment.

Siam *et al*. (2008) nitrogen fertilization of maize was investigated, and it was shown that nitrogen applied at 140 kg ha^{-1} significantly increased plant height and dry weight of leaves compared to nitrogen administered at 80 kg ha^{-1}.

Kunjir *et al*. (2009) reported that the performance of sweet corn cv. Sumadhur was investigated under the influence of various nitrogen levels (control, 75 kg ha^{-1}, 150 kg ha^{-1}, and 225 kg ha^{-1}) and it was discovered that plant height, number of leaves, and dry matter increased significantly with increasing (N) levels up to 150 kg ha^{-1}, but differences beyond this remained statistically on par.

Kumar *et al*. (2009) reported that the reaction of popcorn to different levels of nitrogen application (control, 40 kg ha^{-1}, 80 kg ha^{-1}, and 120 kg ha^{-1}) indicated that with each consecutive rise in nitrogen levels from control to 120 kg ha^{-1}, taller plants and greater dry weight plant^{-1} were achieved.

Effa *et al*. (2011) according to the reaction of popcorn var. Ashland to progressive nitrogen levels, plant height, leaf area index, and total dry matter increased with each nitrogen level rise up to 120 kg ha^{-1} (control, 40 kg ha^{-1}, 80 kg ha^{-1}, and 120 kg ha^{-1}). Increased nitrogen levels from control to 120 kg ha^{-1}, on the other hand, reduced the number of days tasselling by half.

Mehta *et al*. (2011) reported that nitrogen treatment up to 275 kg ha^{-1} enhanced plant height, leaf area, dry matter, crop growth rate, and relative growth rate significantly above (control, 175 kg ha^{-1}, 200 kg ha^{-1}, and 225 kg ha^{-1}) in Ludhiana, but remained on par with 250 kg ha^{-1}.

Jeet *et al*. (2012) reported that taller plants, broader stem girth, higher number of green leaves, dry weight, crop growth rate, and leaf area index were seen in Varanasi with increased nitrogen treatment up to 150 kg nitrogen ha^{-1} in maize.

Verma *et al.* (2012) reported that when nitrogen levels in maize were raised up to 150 kg ha^{-1}, plant height, total dry matter, leaf area index, number of days to silking, and maturity all improved significantly.

Mahdi *et al*. (2012) according to the impact of different nitrogen levels 60 kg ha^{-1}, 90 kg ha^{-1} on growth components of fodder maize cv. J-1006, plant height and leaf area index significantly increased up to 120 kg ha^{-1}.

Raskar *et al*. (2012) experiment was studied that plant height increased by up to 160 kg ha^{-1} when nitrogen levels were increased, but plant height remained constant at 120 kg ha^{-1}.

Jena *et al*. (2015) recorded that on quality maize protein in Rajendranagar, Hyderabad, researchers found that applying 100 kg P ha^{-1} resulted in taller plants and higher leaf area index than the other phosphorus levels of (0, 60 kg ha^{-1}, and 80 kg ha^{-1}).

2.2 Effect of NPK levels on yield attributes and yield

Neupane *et al.* (2017a) emphasized that winter baby corn be applied with 150 kg N ha^{-1} (Soil + foliar) to harvest higher yield and quality.

Neupane *et al.* (2017b) stated that higher yield and yield attributes may be obtained by N management and N application 50% as basal and rest in two equal splits at critical stages is best however, use of small amount of N as foliar spray close to sink may further enhance the yield and quality of the winter baby corn irrespective of the cultivar.

In season management of N facilitates corrections as per crop need and thus seems more appropriate than uniform applications based on blanket recommendations. Temporal and spatial variations in status of soil N may be addressed with improved N use efficiency by site specific nutrient management.

Arya and Singh (2000) studied that the reaction of maize to various phosphorus levels control + 30 kg ha^{-1} + 60 kg ha^{-1}, and 90 kg ha^{-1} resulted in considerably greater grains and straw yield with increasing phosphorus levels up to 90 kg P_2O_5 ha^{-1}.

Kumar and Puri (2001) observed that application of 90 kg ha^{-1} N and 15 t FYM ha^{-1} gave maximum cob length, grains per cob, grain weight, stover and grain yield compared to 0 and 45 kg N ha^{-1} in maize.

Raja *et al*. (2001) reported that all the yield attributing characters like ear weight and yield of green kernel of super sweet corn were significantly superior with 120 kg N ha^{-1} over 80, 40 kg N ha^{-1} and control. In sweet corn, cob diameter and cob weight with and without husk considerable under combination of 200 kg N ha^{-1} along with 80 kg P_2O_5 ha^{-1}.

Singh and Sarkar (2001) studied that 210-90-150 NPK kg ha^{-1} gave higher grain yield with an additional increase of 33.0% over the state recommended level of NPK fertilization (100-60-40 NPK kg ha^{-1}).

Venkatesh *et al*. (2002) studied that with increasing amounts of phosphorus up to 60 kg P_2O_5 ha^{-1}, substantially increased test weight and maize yield were reported.

Panwar and Munda (2006) experiment was studied that during the rainy season of 2001 and 2002, they conducted a field experiment in Umiam (Meghalaya) to investigate the response of baby corn cv. Vijay composite to nitrogen doses. They discovered that applying 120 kg ha^{-1} reduced the days to baby corn initiation but extended the harvesting period over 80 kg ha^{-1}.

Dixit *et al*. (2006) studied that the absorption when the phosphorus level was elevated to 39 kg P_2O_5 ha^{-1}, the amount of nitrogen, phosphorus and potassium absorbed by maize grain and stover rose considerably.

Choudhary *et al*. (2006) recorded that increase in nitrogen treatment up to 120 kg N ha^{-1} considerably enhanced maize grain and fodder yields.

Meena *et al*. (2007) the response of maize to nitrogen levels (control, 40 kg ha^{-1}, 80 kg ha^{-1}, and 120 kg ha^{-1}) was investigated and it was shown that cob length and diameter, as well as grain and straw yield, rose considerably as nitrogen levels increased up to 120 kg ha^{-1}.

Ahmad *et al*. (2007) studied that the reaction of maize to varied amounts of phosphorus (60 kg ha^{-1}, 90 kg ha^{-1}, and 120 kg ha^{-1}) was investigated, and it was shown that grain production rose considerably as phosphorus treatment levels increased up to 120 kg P_2O_5 ha^{-1}.

Ghodpage *et al*. (2008) studied that discovered that applying phosphorus at 40 kg P ha^{-1}, 60 kg P ha^{-1}, and 80 kg P ha^{-1} improved maize production by 11%, 18%, and 20% over control, respectively.

Rao *et al*. (2009) in this experiment there was a significant increase in baby cob weight, baby cobs $plant^{-1}$, baby cob yield, and green fodder production with increased nitrogen treatment up to 120 kg ha^{-1}, according to the study.

Neupane *et al*. (2011) observed that application of 75% N through urea+ 25% N through FYM were found the best source of nitrogen and emerged as superior in relation to yield attributes *viz.* cobs $plant^{-1}$, cob length and cob girth and finally resulted in higher yield of corn for commercial cultivation of baby corn.

Singh *et al*. (2012) studied that nitrogen treatment had a significant influence on sweet corn production indices such as number of cobs, green cob weight, kernel cob^{-1}, 1000-kernal weight, kernel recovery, and barrenness (percent) up to 150 kg ha^{-1}, but statistically on par with 120 kg ha^{-1}. They also discovered that raising nitrogen application levels to 120 kg ha^{-1} considerably increased green cob and fresh corn yields while staying equivalent to 150 kg ha^{-1}. However, in comparison with 90 kg ha^{-1}, 60 kg ha^{-1}, 30 kg ha^{-1}, and control, 120 kg ha^{-1} enhanced green cob yield by 7.7%, 19.9%, 33.9 percent, and 128 percent, respectively. In terms of green fodder yield, applying 120 kg ha^{-1}, which is comparable to 150 kg ha^{-1}, improved green fodder yield by 127.5 percent, 51.5 percent, 24.1 percent, and 6.3 % over control, 30 kg ha^{-1}, 60 kg ha^{-1}, and 90 kg ha^{-1}, respectively.

Shivran *et al*. (2013) reported significantly higher grain and stover yield of maize with application of increasing levels up to 40 kg P_2O_5 ha^{-1}.

2.3 Effect of NPK levels on economics

Sahoo and Panda (2001) reported that using 26.2 kg P ha^{-1} instead of 17.5 kg P ha^{-1} had a substantially better net return on baby corn, but it was still comparable to 35 kg P ha^{-1}.

Kumar and Thakur (2004) discovered that applying 150 % RDF 120 kg NPK ha^{-1}, 22.5 kg NPK ha^{-1},117 kg NPK ha^{-1} resulted in significantly higher net returns (₹ 19,655 ha^{-1}) than using 100% RDF 120 NPK ha^{-1}, 22.5 NPK ha^{-1}, 117 kg NPK ha^{-1}, 100% RDF+10 tonnes farm yard manure (FYM) ha^{-1}, and 50 percent RDF 60 kg NPK ha^{-1},11.25 kg NPK ha^{-1},58.5 kg NPK ha^{-1} +10 tonnes FYM ha^{-1} in maize.

Kumar *et al*. (2005) studied that 100 percent nitrogen, phosphorus, potassium (NPK) 120 ,26.2 , 33.2 kg NPK ha^{-1} in maize produced the highest net returns ha^{-1} (₹ 11,443) and net returns rupee^{-1} invested (₹ 1.12).

Bhagat *et al.* (2006) studied that when the solitary sweet corn is fed with 125(%) RDF, the maximum net financial returns and B:C ratio were reported.

Kar *et al.* (2006) reported that in sweet corn, the application of 80 kg nitrogen ha^{-1} resulted in the maximum gross returns (₹ 61,532 ha^{-1}) & B:C ratio (3.76), followed by nitrogen levels (60 kg ha^{-1} and 40 kg ha^{-1}).

Sahoo and Mahapatra (2007) reported that the results of a field trial conducted in Jashinpur, Orissa during the *rabi* season on well-drained sandy loam soil on sweet corn, the maximum net profit of (₹ 44,215 ha^{-1} & ₹ 45,952 ha^{-1}) was recorded under 120 kg nitrogen ha^{-1}, 26.2 kg phosphorus ha^{-1}, and 50 kg potassium ha^{-1} over control and other fertilizer levels, with a B:C ratio of 3.89 : 3.82.

Choudhary *et al*. (2008) reported that the application of 120 N kg ha^{-1} + 60 kg P_2O_5 ha^{-1} yielded a substantially greater net return ha^{-1} of (₹ 30,101 ha^{-1}) than the control, although it was on par with (90 kg N ha^{-1} + 45 kg P ha^{-1}). In maize, the application of 120 kg N ha^{-1} and 50 kg P ha^{-1} resulted in a substantial increase in net return when compared to the control.

Singh *et al*. (2010) studied that with each consecutive increase in nutrients levels up to (180 kg ha^{-1} + 38.7 kg ha^{-1} + 74.7 kg ha^{-1}) the gross return and B:C ratio in baby maize increased considerably.

Singh *et al*. (2012) studied that in sweet corn, it was discovered that applying nitrogen (N) 150 kg ha^{-1} was equivalent to applying 120 kg ha^{-1}, but it significantly enhanced crop profitability (635.9 ha^{-1} day^{-1}), net returns (65.49 x 103 ha^{-1}) and returns $rupee^{-1}$ invested (6.35) above the previous level.

Chapter III

MATERIALS AND METHODS

The techniques utilized in the current study to attain the aims are described in this chapter. It covers the study length, the study region, materials, selection of research instruments, the selection of research designs and analytical tools as well as techniques used for the conduct of the current study entitled **"To study the effect of NPK levels on growth and yield of late sown winter baby corn (***Zea mays* L.**)".**

3.1 Experimental site

In 2021 the experiment was conducted in the RGSC in Agricultural Research Farm, Banaras Hindu University in Barkachha, Mirzapur (UP), during *rabi* season. It is situated in Vindhyan at 25,146 N latitude, 82,569 S longitudes (Robertsgunj) and 128,93 meters above sea level in altitude. It covers an elevation of 82.569 S. The surface is rain fed with red laterite and poor fertility in the soil type of Barkachha. Agro-climate zone III-A is the Vindhyan area (semi-arid eastern plain zone).

3.2 Climate and weather

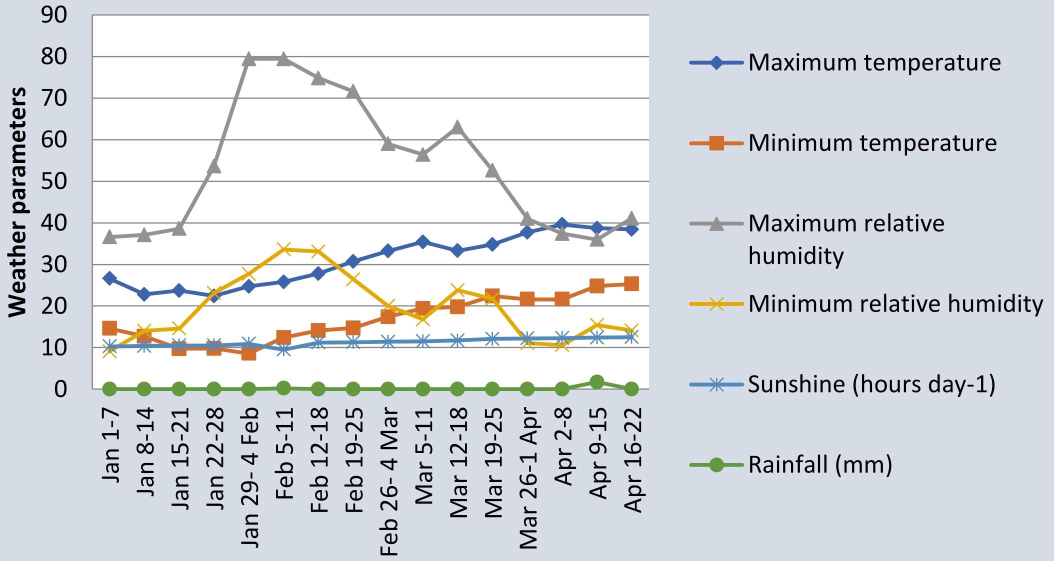
Mirzapur is situated in a semi-arid to sub-humid area, in the Rajiv Gandhi South Campus (RGSC), where warm and moist rainy (June - October) in the summer seasons and chilly winters (November – February), is distinguishable. The warmest months in the area (May-43,1°C to 48,0°C) and the coldest in summer and winter months (January - 4^{o}C to 7^{o}C) are hot & dry. The yearly average rainfall is 950 mm. Seventy-five percent of the total annual precipitation in this region was obtained between June and September, i.e. 3rd week of June to the end of September. Barkachha's moisture remains 65%, reaching 90.85% (July to September) and dropping between April and June.

Table 3.2: Mean standard week-wise meteorological parameters during the experiment (January to April, 2021)

Standard week	Month & date	Rainfall (mm)	Temperature (°C)		Relative Humidity (%)		Sunshine (hours day^{-1})
			Max	Min	Max	Min	
1	Jan 1-7	0.0	26.6	14.6	36.6	9.1	10.3
2	Jan 8-14	0.0	22.8	12.7	37.1	14	10.4
3	Jan 15-21	0.0	23.7	9.7	38.6	14.6	10.5
4	Jan 22-28	0.0	22.4	9.8	53.6	23.1	10.5
5	Jan 29- 4 Feb	0.0	24.7	8.6	79.4	27.7	10.9
6	Feb 5-11	0.2	25.8	12.4	79.4	33.6	9.5
7	Feb 12-18	0.0	27.8	14.1	74.8	33.1	11.2
8	Feb 19-25	0.0	30.7	14.7	71.6	26.4	11.3
9	Feb 26- 4 Mar	0.0	33.2	17.4	59.0	20	11.4
10	Mar 5-11	0.0	35.4	19.4	56.4	16.8	11.5
11	Mar 12-18	0.0	33.3	19.8	63.0	23.8	11.7
12	Mar 19-25	0.0	34.8	22.4	52.6	21.7	12.1
13	Mar 26-1 Apr	0.0	37.7	21.6	41	11.1	12.2
14	Apr 2-8	0.0	39.6	21.6	37.4	10.6	12.3
15	Apr 9-15	1.7	38.7	24.8	36.0	15.4	12.4
16	Apr 16-22	0.0	38.4	25.3	41.1	14.1	12.5
17	Apr 23-29	0.0	40.0	24.1	35	24.6	12.7

Source: Observatory, Vikas Bhawan, R.G.S.C, BHU, Mirzapur

Fig 3.2 Weather data during investigation



3.2.1 Weather during the crop season

Temperature, relative humidity, rainfall and sunlight hours of the week were observed between January-April 2021 and standard weekly data are provided in Table 3.2 and Fig. 3.2.

3.2.1.1 Rainfall (mm)

The amount of precipitation in the cultivation time during the 15th standard week was just 1.7 (09-15April, 2021).

3.2.1.2 Temperature (°C)

Data about the weekly temperature shows that the maximum mean and lowest temperatures throughout the planting season respectively are 9.7°C and 23.7°C during 16th standard week (23-29 April). The most temperature changes recorded were 40 °C, while at least 8.6 in 4th standard week (29 January-04 Feb.).

3.2.1.3 Relative humidity (%)

In the experiment period, the average weekly maximum and minimum relative humidity of 79.4 and 10.6 percent respectively were recorded.

3.2.1.4 Sunshine hour's day^{-1}

During the cultivation time, the highest and the lowest day length was 12.7 hours daily^{-1} and 9.5 hours day^{-1}.

3.3 Soil and soil analyses

With the assistance of a soil boom, the soil sample was made using appropriate measurements at a depth of 15 cm. The samples taken have been air-dried, broken down, and transmitted to the 2 mm sieve and then tests for the mechanical, physical and chemical characteristics of an experimental soil using a conventional laboratory analytical method. The observations are shown in the Table 3.3.

Table 3.3: Mechanical and physio-chemical properties of the experimental soil

Particulars	Value	Method employed
A. Mechanical composition		
Sand (%)	51.7	Hydrometric method (Bouyoucos, 1962)
Silt (%)	36.5	
Clay (%)	11.8	
Textural class	Sandy loam	Textural triangle (Black *et al.*, 1965)
B. Physical constants		
Bulk density (g cm^{-3})	1.32	Core sampler (Piper, 1966)
Particle density (g cm^{-3})	2.65	Core sampler (Piper, 1966)
Maximum water holding capacity (%)	29	Keen's box (Black *et al.*, 1965)
C. Chemical properties		
Organic carbon (%)	0.33	Walkley and Black's rapid titration method (Walkley and Black, 1934)
Available nitrogen (kg ha^{-1})	163.12	Alkaline permanganate method (Subbiah and Asija, 1956)
Available phosphorus (kg ha^{-1})	20.34	0.5 M $NaOH_3$ extractable Olsen's method (Olsen *et al.*, 1954)
Available potassium (kg ha^{-1})	230.47	Ammonium acetate extractable flame photometer method (Jackson, 1973)
Soil reaction pH (1:2.5 soil : water suspension)	6.74	Glass electrode digital pH meter (Jackson, 1973)
Electrical conductivity (d Sm^{-1}) at 25 ºC	0.25	Systronics electrical conductivity meter (Jackson, 1973)

3.4 Experimental details

In the *rabi* season, the experiment was conducted. Corn seed was seeded into the pot and experimented with Complete Randomized Design (CRD) involving seven levels of NPK *viz.* control (T_0), T_1: 30-15-10 kg ha^{-1}, T_2: 60-30-20 kg ha^{-1}, T_3: 90-45-30 kg ha^{-1}, T_4: 120-60-40 kg ha^{-1}, T_5: 150-75-50 kg ha^{-1}, T_6: 180-90-60 kg ha^{-1} were administered to assess their influence on the growth and production of baby corn. The recommended dose of baby corn in the NPK levels, treatments with their symbols and layout specifics are described in Tables 3.4.1 and 3.4.2.

Table 3.4.1: NPK levels

NPK (kg ha^{-1})
Control
30-15-10
60-30-20
90-45-30
120-60-40
150-75-50
180-90-60

Table 3.4.2: Detail of treatments with symbol used

Treatments	Treatments details (NPK kg ha^{-1})
T_0	Control
T_1	30-15-10
T_2	60-30-20
T_3	90-45-30
T_4	120-60-40
T_5	150-75-50
T_6	180-90-60

Table 3.4.3: Layout details

Site of Experiment	:	Agricultural Research Farm, RGSC
Season	:	*Rabi*
Experimental design	:	Complete Randomized Design
No. of treatments	:	7
No. of replications	:	3
Total number of plots	:	7 × 3 = 21
Crop	:	Baby corn
Variety	:	HIRA BSHM-21 (Hybrid maize variety)
Year	:	2021

Table 3.4.4: Layout plan of experiment

R1	R2	R3
NPKT1	0	NPKT4
0	NPKT1	NPKT2
NPKT3	NPKT5	NPKT1
NPKT5	NPKT2	NPKT3
NPKT6	NPKT4	NPKT5
NPKT2	NPKT6	0
NPKT4	NPKT3	NPKT6

3.5 Field operations

Descriptions of baby corn activities throughout the experiments are detailed here and are summarized in Table 3.5.

3.5.1 Soil preparation

As a soil sample location, agro forestry planting block has been chosen to have a representative area soil. The sample equipment was cleaned with soap and water washed. In order to calculate the need, the amount of soil for each pot (kg) is multiplied by the number of pots. The surface vegetation was cleared at the sampling sites first. Soil samples from the middle of tree ranges were obtained from a depth of 0-20 cm, preventing depression from various pre-fixed sites. The dirt collected was carefully blended and bulked into a consistent composite sample. Finally, for each pot, the pots were also filled with weighted soil.

3.5.2 Variety

HIRA BSHM-21 was utilized by Bapna Group, a private enterprise. The maize hybrid was employed. The test species lasted between 90-100 days for grain crops, whereas baby corn production lasted around 75 days.

3.5.3 Seed and Sowing

Randomly placed pots were filled with five kilograms of air-dry soil mass. Two seeds (3-4 days soaking) have been put in each pot to minimize any germination failures at a 4-5 cm depth. Only one plant was kept in each container after successful germination.

3.5.4 Fertilizer Application

The dose of fertilizer for each treatment was based on soil weight. The sources were Urea (46% N) Single Super Phosphate (SSP - 16% P), and muriate of Potash (MOP - 60% K_2O). At the time of planting the baseline dosage was used as nitrogen, phosphorus and potassium. The other half is divided into two portions of same nitrogen and is administered at the high knee stage and at the tassel appearance of the crop.

Table 3.5: Summary of operations performed during baby corn cultivation

S.No.	Operation		Date of operation
1	Soil collection	:	11-01-2021
2	Pot arrangement	:	13-01-2021
3	Composite soil preparation	:	14-01-2021
4	Filling pots	:	14-01-2021
5	Sowing	:	15-01-2021
6	Basal fertilizer application	:	15-01-2021
	First top dressing	:	16-02-2021
	Second top dressing	:	01-03-2021
7	Thinning	:	12-02-2021
8	Pesticide application	:	1-02-2021
9	Irrigation	:	Five irrigations (15 days interval)
10	Detasselling	:	18-03-2021
11	Cob picking	:	26-03-2021 to 08-04-2021
12	Harvesting green fodder	:	08-04-2021

3.5.5 Irrigation

After planting, the pots were given water to help the seeds germinate. Then after, the crop was watered at a fifteen-day interval. The pots were watered with metered water to prevent irrigation.

3.5.6 Detasselling

By carefully tugging them upwards, the tassels were removed manually from all of the plants. This is a key procedure for baby corn that was done to control pollination and fertilization shortly after the appearance of the tassel. Detasseling is a useful method to make good quality baby corn with high yields.

3.5.7 Protection measures

Before planting, seeds were treated to prevent fungal infection with Bavistin @ 1.5-2g kg^{-1} seed. Insectic Carbofuran granules (Furadan 3G), a spotted stem borer (Chilo partellus) and a pink stem borer (Sesamia inferens), was administered per each plant following 25 days of sowing (DAS).

3.6 Biometric observations

3.6.1 Growth attributes

Baby corn characteristics were recorded at 25, 50 DAS and 75 DAS at the time of harvest, including height of the plant, number of leaves $plant^{-1}$ and dry weight $plant^{-1}$. Leaf area Plant $^{-1}$ and chlorophyll a & chlorophyll b at 50 & 75 DAS were registered.

3.6.2 Plant height (cm)

For each plant, the plant height was measured at 25, 50, 75 DAS and on harvest from base to tip. For each treatment's average height was determined and expressed in centimeters.

3.6.3 Leaf area plant^{-1}

The total number of operating leaves was computed and the leaf area, which was represented in cm^2, was calculated by means of graphs.

3.6.4 Number of leaves plant^{-1}

For each replication, the total green leaves were counted, summarized and averaged at 25, 50 and 75 DAS for all processes at harvest and as the number of leaves plant^{-1}

3.6.5 Chlorophyll content

With 90% acetone solution the fresh leaves have been chopped and crushed by morter and pestle. With 4ml of acetone & 2ml ethanol and removed for a minute, a completely ground paste of leaf material was added. It remained in the freezer for 30 minutes (in dark). It was carried out for 10 minutes at centrifuge at 2000 rpm. In order to avoid contamination, the samples were wrapped with aluminium foil. The samples were then added and removed for one minute with 5 mL (2:1) of acetone and ethanol. Before reading, the spectrophotometer was maintained ready and with the combination acetone and ethanol adjusted in zero. Finally, absorption measurements in spectrophotometer were made at 663nm and 645nm and computed using the following equations.

$$\text{Chlorophyll a (mg/g)} = (12.7 * A\ 663) – (2.59 * A\ 645)$$

$$\text{Chlorophyll b (mg/g)} = (22.9 * A\ 645) – (4.7 * A\ 663)$$

3.6.6 Dry matter accumulation

For calculation of dry weight plants^{-1}, the plants utilized for the calculation of the leaf area plant^{-1} were employed. Three days of sun-drying were broken into pieces and after 48 hours, oven-dried and weighed at a temperature of 70 degrees Celsius.

3.7 Yield and yield attributes

3.7.1 Number of baby cobs plant^{-1}

The total number of cobs was measured for each plant until harvest and was then measured separately for each treatment.

3.7.2 Baby cob weight (g)

Weighed and documented every baby cob weight including husk. The findings of each replication for each treatment were summarized and average to evaluate baby cob weight in grams.

3.7.3 Baby corn weight (g)

De-husked cobs were removed and weighed from each plant. The findings were measured in terms of a baby corn weight in grams for every treatment. Every cob infant weight including the husk was weighed. The results of all the replications were summarized and estimated on an average for infant corn weight in grams.

3.7.4 Baby cob: baby corn ratio

Total baby corn weight and cob weight have been recorded and computation of their ratio was done independently.

3.7.5 Baby corn length (cm)

To record the length of each corn, all the cobs were de-husked. For all the treatments, the average length for the determination of baby corn length has been determined.

3.7.6 Baby corn girth (cm)

Digital Vernier Calipers were utilized for calculating the corn girth and the treatment of the average size of baby corn.

3.7.7 First cob harvest (days)

The first cob harvest of all plants from the date of planting was monitored and the average treatment in terms of days.

3.7.8 Total harvest period (days)

The number of days in which cobs were collected for all plants is indicated in days.

3.7.9 Baby cob yield plant^{-1} (g plant^{1})

Individual weights of the new born cob-weight plant^{-1} were obtained for each replication and represented in cob yield plant^{-1} and g-plant^{-1} for each treatment.

3.7.10 Baby corn yield plant^{-1} (g plant^{-1})

The weight of baby corn plant^{-1} was calculated. The replicate was weighed individually for each baby corn yield plant^{-1} of every treatment and is shown in g plant^{-1}

3.7.11 Green fodder yield (g plant^{-1})

The plants were cut off from the ground level after removing cobs and green fodder yields in g plant $^{-1}$.

3.8 Statistical analysis

Completely Randomized Design (CRD)

CRD is the fundamental design of a single factor. The therapy in this design is entirely altered such that every experimental unit is able to get the identical treatment. But CRD is only suitable if the experimental material is uniform. Due to several variables CRD is not recommended in field experiments as there is often considerable variance in the experimental plots. It is simple to obtain homogeneity of experimental materials in laboratory experiments and greenhouse study and hence CRD in these experiments is most important.

Layout of a CRD

Completely randomized Design is the one in which all the experimental units are integrated as homogenous as feasible into a single group. The randomization process will be followed to assign treatments to different units.

Step 1: Determine the total number of experimental units.

Step 2: Assign a plot number to each of the experimental units starting from left to right for all rows. Step 3: Assign the treatments to the experimental units by using random numbers.

The statistical model for CRD with one observation per unit

$Yij = \mu + ti + eij$

Where,

μ = overall mean effect

ti = true effect of the i th treatment

eij = error term of the jth unit receiving ith treatment

The arrangement of data in CRD is as follows:

The null hypothesis will be Ho: $\mu 1 = \mu 2 = \ldots\ldots\ldots\ldots = \mu k$ or There is no significant difference between the treatments

And the alternative hypothesis is

H1: $\mu 1 \neq \mu 2 \neq \ldots\ldots\ldots\ldots \neq \mu k$.

There is significant difference between the treatments

Source of variation	**Df**	**SS**	**MSS**	**F (Cal.)**	**F (Tab.) at 5%**
Due to treatments	(t-1)	Tr.SS	Tr.SSA/ t-1	MSST/MSSE	
Due to replications	(r-1)	RSS	RSS/r-1	MSSR/MSSE	
Total	(r-1) (t-1)	ESS	ESS		

Where,

Standard error of mean was calculated by the following formula:

$$\textbf{SEm} = \sqrt{\frac{\textbf{2 x Error sum of square}}{\textbf{r}}}$$

Where,

Critical difference was calculated by the following formula:

CD = S.E. difference mean × t 0.05 (error d.f)

Where,

$\bar{x}$	=	Mean
σ	=	Standard deviation
r	=	Number of replications
df	=	Degree of freedom
SS	=	Sum of square
ESS	=	Error sum of squares
SEd	=	Standard error deviation

Chapter IV

EXPERIMENTAL FINDINGS

During the research, the observations of all the parameters were collected and statistical analysis was performed for meaningful findings. The research findings and discussions titled **"To study the effect of NPK levels on growth and yield of late sown winter baby corn (*Zea mays* L.)"** The analysis and presentation in this section have been criticized. The parameters are also shown using charts wherever it is important to understand the findings

GROWTH PARAMETERS

4.1.1 Plant height (cm)

The mean data of plant height as influenced by NPK levels of baby corn recorded at 25, 50, 75 and at harvest are presented in Table 4.1.1 and Fig. 4.1.1. Plant height gradually increased with the advancement of crop age and reached maximum at harvest. Application of NPK levels at all phases of growth, it had a significant impact on the plant's height.

At 25 DAS, maximum plant height (17.36 cm) was recorded with application of NPK level 180-90-60 kg ha^{-1} (T_6) which was significantly superior over the treatments and control(T_0), NPK level 30-15-10 kg ha^{-1} (T_1) and NPK level 60-30-20 kg ha^{-1} (T_2) lower-level values are obtained but remained on par with application of NPK level (T_5) 150- 75-50 kg ha^{-1} (17.34 cm), NPK level (T_4) 120-60-40 kg ha^{-1} (17.22cm) and NPK level (T_3) 90-45-30 kg ha^{-1} (15.79cm).

At 50 DAS, maximum plant height (52.35cm) was recorded with the application of NPK180-90-60 kg ha^{-1} (T_6) which was significantly superior over the rest of the treatments and remained on par with the use of NPK level (T_5) 150-75-50 kg ha^{-1} (49.91 cm). Plant growth indicate lowest plant height was recorded in control (T_0).

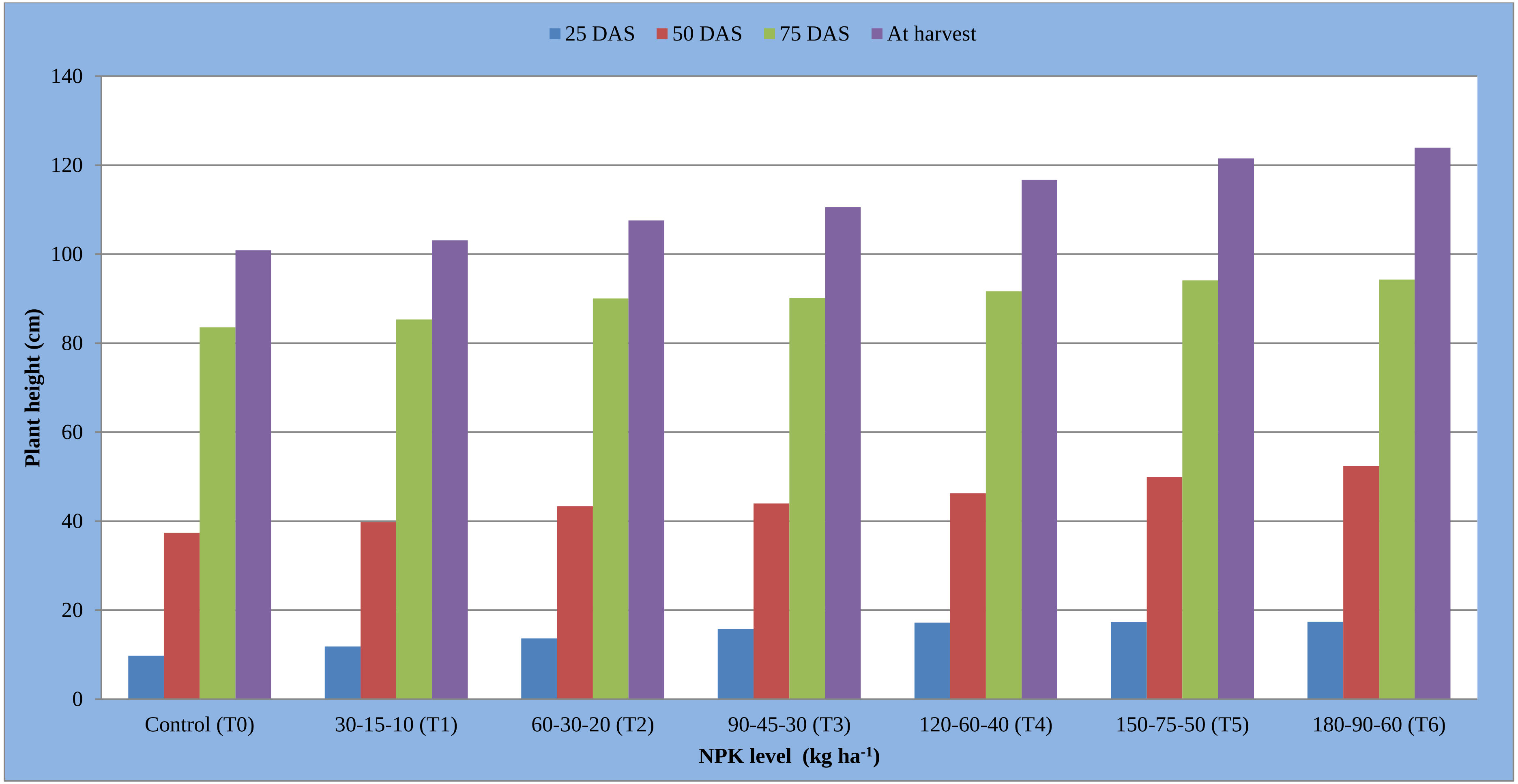
At 75 DAS, maximum plant height was recorded with the use of the highest NPK level (T_6) 180-90-60 kg ha^{-1} (94.28 cm) which was registered statistically at par with NPK level (T_5) 150-75-50 kg ha^{-1} (94.14 cm) and NPK level (T_4) 120-60-40 kg ha^{-1} (91.67). Control (T_0) is lowest plant height was observed in this treatment.

At harvest, maximum plant height was recorded at the treatment NPK level (T6) 180-90-60 kg ha^{-1} (123.90 cm) found statistically at par with NPK level (T_5) 150-75-50 kg ha^{-1} (121.55 cm) and NPK level (T_4) 120-60-40 kg ha^{-1} (116.68 cm). Least plant height registered in control (T_0).

Table 4.1.1: Effect of NPK levels on plant height (cm) of late sown winter baby corn.

Treatments	Plant height(cm)			
	25 DAS	**50 DAS**	**75 DAS**	**At harvest**
NPK levels (kg ha^{-1})				
T_0: Control	9.74	37.38	83.56	100.90
T_1: 30-15-10	11.82	39.77	85.29	103.09
T_2: 60-30-20	13.63	43.30	90.02	107.59
T_3: 90-45-30	15.79	43.94	90.14	110.58
T_4: 120-60-40	17.22	46.27	91.67	116.68
T_5: 150-75-50	17.34	49.91	94.14	121.55
T_6: 180-90-60	17.36	52.35	94.28	123.90
SEm±	1.02	0.94	0.98	0.87
CD (P = 0.05)	3.12	2.87	2.97	2.64

Fig. 4.1.1: Effect of NPK levels on plant height (cm) of late sown winter baby corn



4.1.2 Number of leaves plant^{-1}

In the present study, results revealed that different application of NPK levels exerted a significant effect on number of leaves plant^{-1} at 25, 50, 75 DAS and at the harvest stage presented in Table 4.1.2 and Fig. 4.1.2.

At 25 DAS, the maximum number of leaves (5.67) was recorded due to NPK level (T_6) 180-90-60 kg ha^{-1} found statistically at par with level (T_5) 150-75-50 kg ha^{-1} (5.33) and level (T_4) 120-60-40 kg ha^{-1} (4.67) and (T_3) 90-45-30 kg ha^{-1} (4.67). The lowest number of leaves observed treatment control (T_0).

At 50 DAS, the maximum number of leaves was recorded with treatment (T_6) 180-90-60 kg NPK ha^{-1} (10.33) statistically at par with (T_5) 150-75-50 kg ha^{-1} (10.00), (T_4) 120-60-40 kg ha^{-1} (9.67), (T_3) 90-45-30 kg ha^{-1} (9.33) and (T_2) 60-30-20 kg ha^{-1} (9.00).

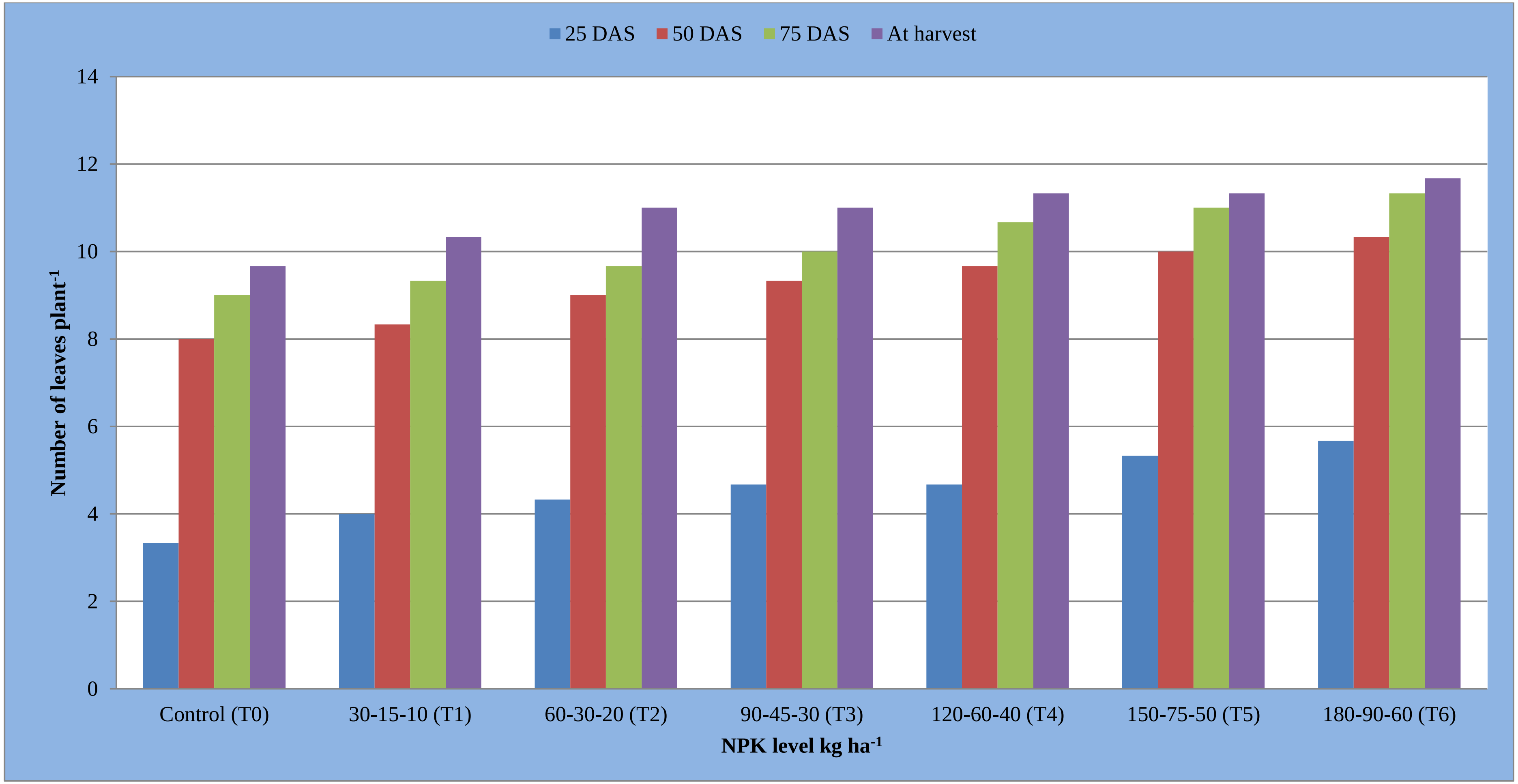
At 75 DAS, the maximum number of leaves was recorded with treatment (T_6) 180-90-60 kg ha^{-1} (11.33) statistically at par with level (T_5) 150-75-50 kg ha^{-1} (11.00), (T_4) 120-60-40 kg ha^{-1} (10.67) and (T_3) 90-45-30 kg ha^{-1} (10.00) but significantly superior to $T_{2,}$ T_1 and T_0.

At harvest, the maximum number of leaves was recorded because of (T_6) 180-90-60 kg NPK ha^{-1} (11.67) and statistically at par with NPK level 150-75-50 kg ha^{-1} (11.33), (T_4) 120-60-40 kg ha^{-1} (11.33), (T_3) 90-45-30 kg ha^{-1} (11.00), (T_2) 60-30-20 kg ha^{-1} (11.00). The lowest number of leaves noted in control (T_0).

Table 4.1.2: Effect of NPK levels on number of leaves $plant^{-1}$ of late sown winter baby corn.

Treatments	Number of leaves $plant^{-1}$			
	25 DAS	**50 DAS**	**75 DAS**	**At harvest**
NPK levels (kg ha^{-1})				
T_0: Control	3.33	8.00	9.00	9.67
T_1: 30-15-10	4.00	8.33	9.33	10.33
T_2: 60-30-20	4.33	9.00	9.67	11.00
T_3: 90-45-30	4.67	9.33	10.00	11.00
T_4: 120-60-40	4.67	9.67	10.67	11.33
T_5: 150-75-50	5.33	10.00	11.00	11.33
T_6: 180-90-60	5.67	10.33	11.33	11.67
SEm±	0.44	0.45	0.44	0.38
CD (P = 0.05)	1.32	1.37	1.36	1.15

Fig. 4.1.2: Effect of NPK levels on number of leaves plant^{-1} of late sown winter baby corn.



4.1.3 Dry weight plant^{-1} (g)

The data on plant dry weight as influenced by different application treatments of NPK levels at 25, 50, 75 DAS, and at harvest are presented in Table 4.1.3 and Fig. 4.1.3.

At 25 DAS, the highest dry matter accumulation was observed with NPK level (T_6) 180-90-60 kg ha^{-1} (7.78 g) however, response was non-significant at this crop stage but was found significant at later growth stages.

At 50 DAS, maximum dry weight (45.87 g) was recorded with application of highest NPK level (T_6: 180-90-60 kg ha^{-1}) which was significantly superior over the rest of the treatments and remained on par with (T_5) 150-75-50 kg ha^{-1} (45.18 g) and (T_4) 120-60-40 kg ha^{-1} (43.96 g). The lowest dry weight was observed in the control (T_0).

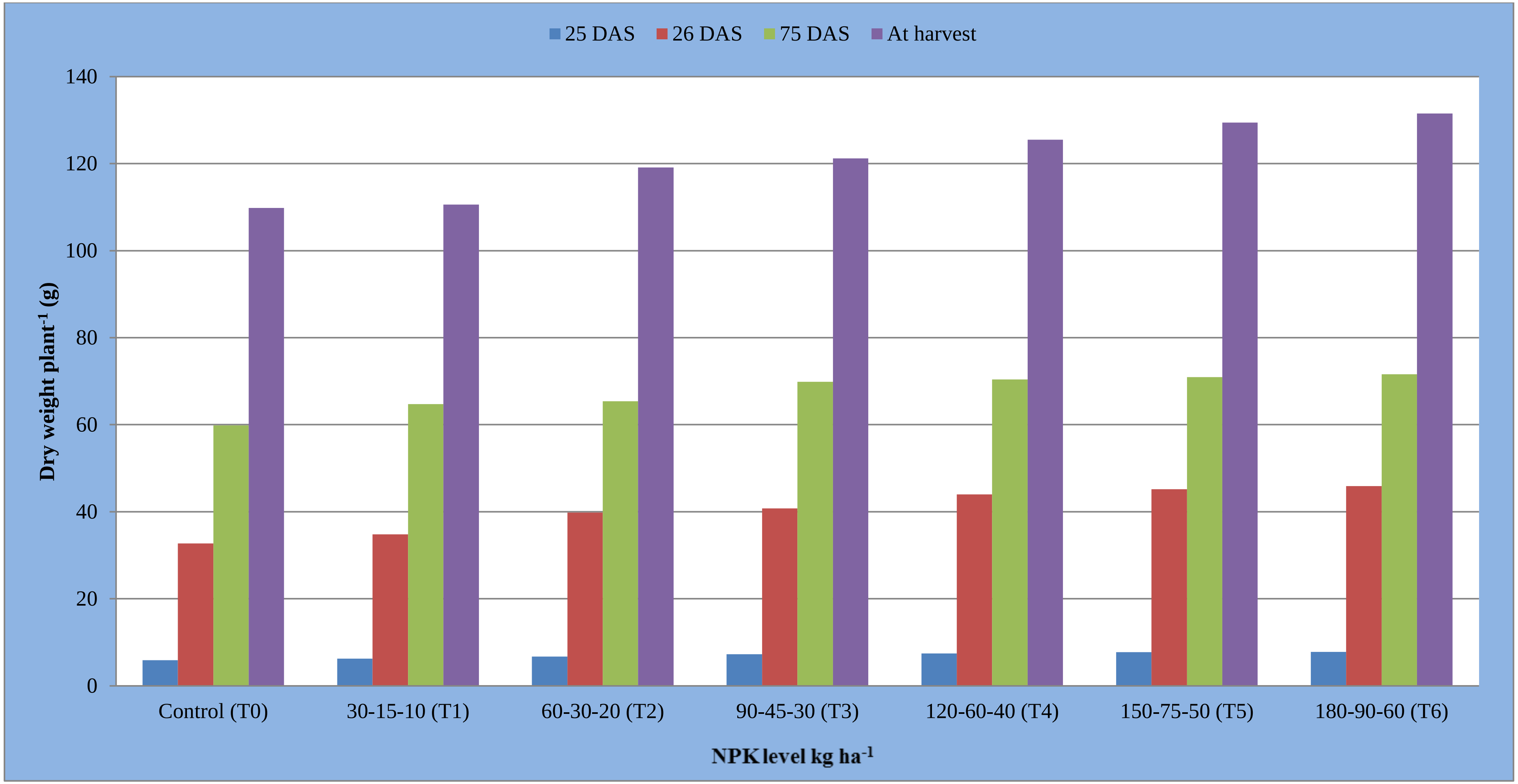
At 75 DAS, maximum dry weight (71.58 g) was recorded with application of NPK level (T_6) 180-90-60 kg ha^{-1} which was significantly superior over the rest of the treatments except T_5: (70.95 g), T_4: (70.39 g), and T_3: (69.88 g), respectively.

At harvest, maximum dry weight (131.52 g) was recorded with application of NPK level (T_6) 180-90-60 kg ha^{-1} which was significantly superior over the rest of the treatments and remained on par with NPK level (T_5) 150-75-50 kg ha^{-1} (129.42 g). The control (T_0) treatment recorded lowest value.

Table 4.1.3: Effect of NPK levels on dry weight plant^{-1} of late sown winter baby corn.

Treatments	Dry weight plant^{-1} (g)			
	25 DAS	**50 DAS**	**75 DAS**	**At harvest**
NPK levels (kg ha^{-1})				
T_0: Control	5.89	32.69	59.87	109.83
T_1: 30-15-10	6.24	34.78	64.71	110.61
T_2: 60-30-20	6.69	39.78	65.39	119.09
T_3: 90-45-30	7.22	40.76	69.88	121.17
T_4: 120-60-40	7.42	43.96	70.39	125.51
T_5: 150-75-50	7.70	45.18	70.95	129.42
T_6: 180-90-60	7.78	45.87	71.58	131.52
SEm±	0.62	1.29	0.87	1.27
CD (P = 0.05)	NS	3.94	2.63	3.87

Fig. 4.1.3: Effect of NPK levels on dry weight plant^{-1} of late sown winter baby corn.



4.1.4 Leaf area plant^{-1}

The data on leaf area plant^{-1} as influenced by different treatments of NPK levels at 50, 75 DAS, and at harvest are presented in Table 4.1.4 and Fig. 4.1.4.

At 50 DAS, maximum leaf area plant^{-1} (373.28) was recorded with application of NPK level (T6) 180-90-60 kg ha^{-1} which was significantly superior over the rest of the treatments. Improvement in the nutrients level caused significant enhancement however (T_4) and (T_5) were remained on par.

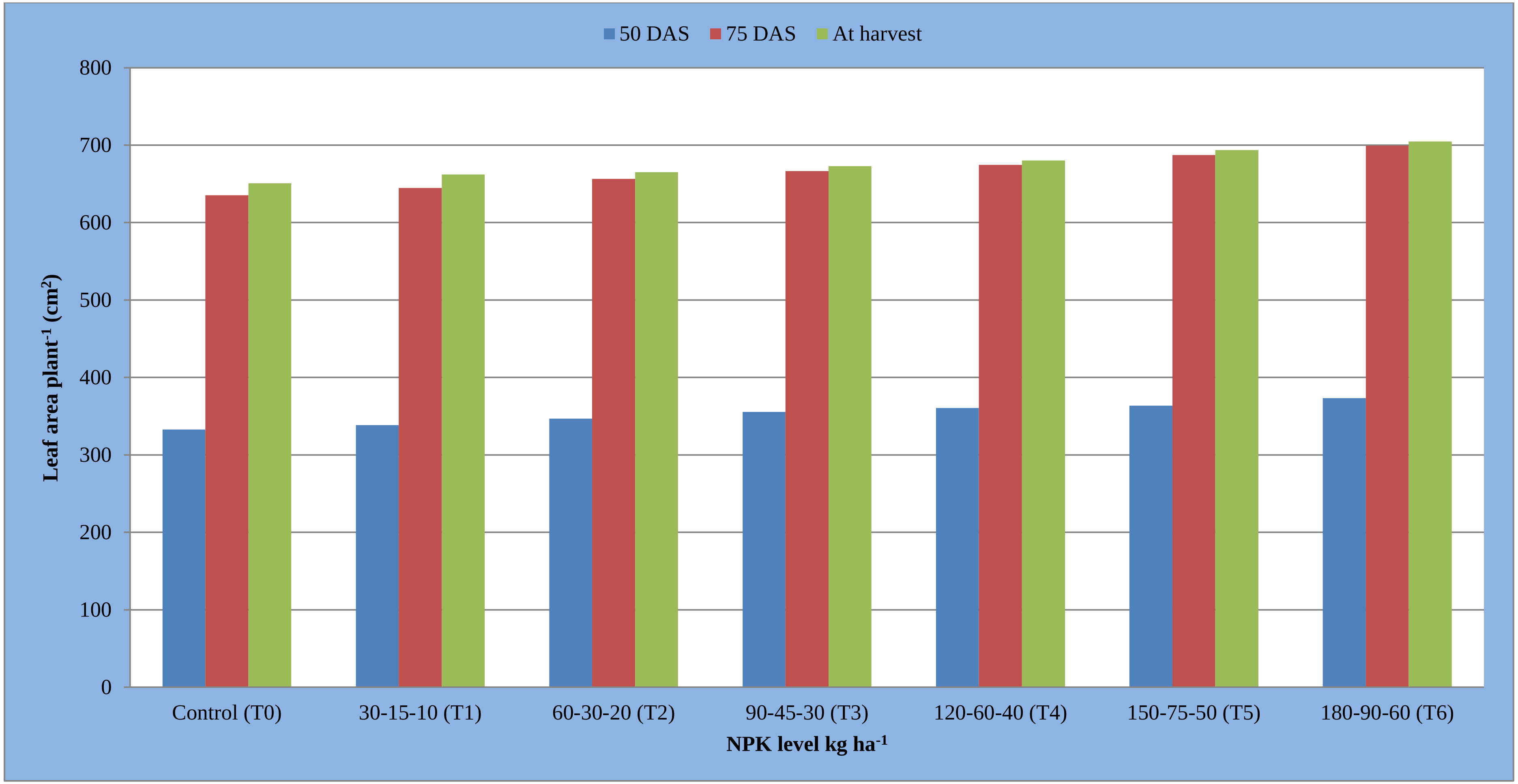
At 75 DAS, leaf area plant^{-1} (699.20) was recorded with application of NPK level (T_6) 180-90-60 kg ha^{-1} which was significantly superior over the rest of the treatments and reduction in the NPK level produced significantly lower leaf area plant^{-1} and minimum values registered with control.

At harvest, highest leaf area plant^{-1} (704.67) was recorded with application of NPK level (T_6) 180-90-60 kg ha^{-1} which was significantly superior over the rest of the treatments. Application of NPK level (T_5) 150-75-50 kg ha^{-1} ranked second (693.52). The lowest leaf area plant^{-1} was recorded in control (T_0).

Table 4.1.4: Effect of NPK levels on leaf area plant^{-1} of late sown winter baby corn.

Treatments	Leaf area plant^{-1} (cm^2)		
	50 DAS	**75 DAS**	**At harvest**
NPK levels (kg ha^{-1})			
T_0: Control	332.79	635.45	650.87
T_1: 30-15-10	338.33	644.75	662.16
T_2: 60-30-20	346.93	656.61	665.16
T_3: 90-45-30	355.64	666.41	673.01
T_4: 120-60-40	360.54	674.50	680.18
T_5: 150-75-50	363.50	687.23	693.52
T_6: 180-90-60	373.28	699.20	704.67
SEm±	1.31	1.26	1.42
CD (P = 0.05)	3.98	3.85	4.31

Fig 4.1.4: Effect of NPK levels on leaf area plant^{-1} of late sown winter baby corn.



Chlorophyll content

4.1.5 Chlorophyll a

The data on plant chlorophyll a content as influenced by different treatments of NPK levels at 50, 75 DAS are presented in Table 4.1.5 and Fig. 4.1.5.

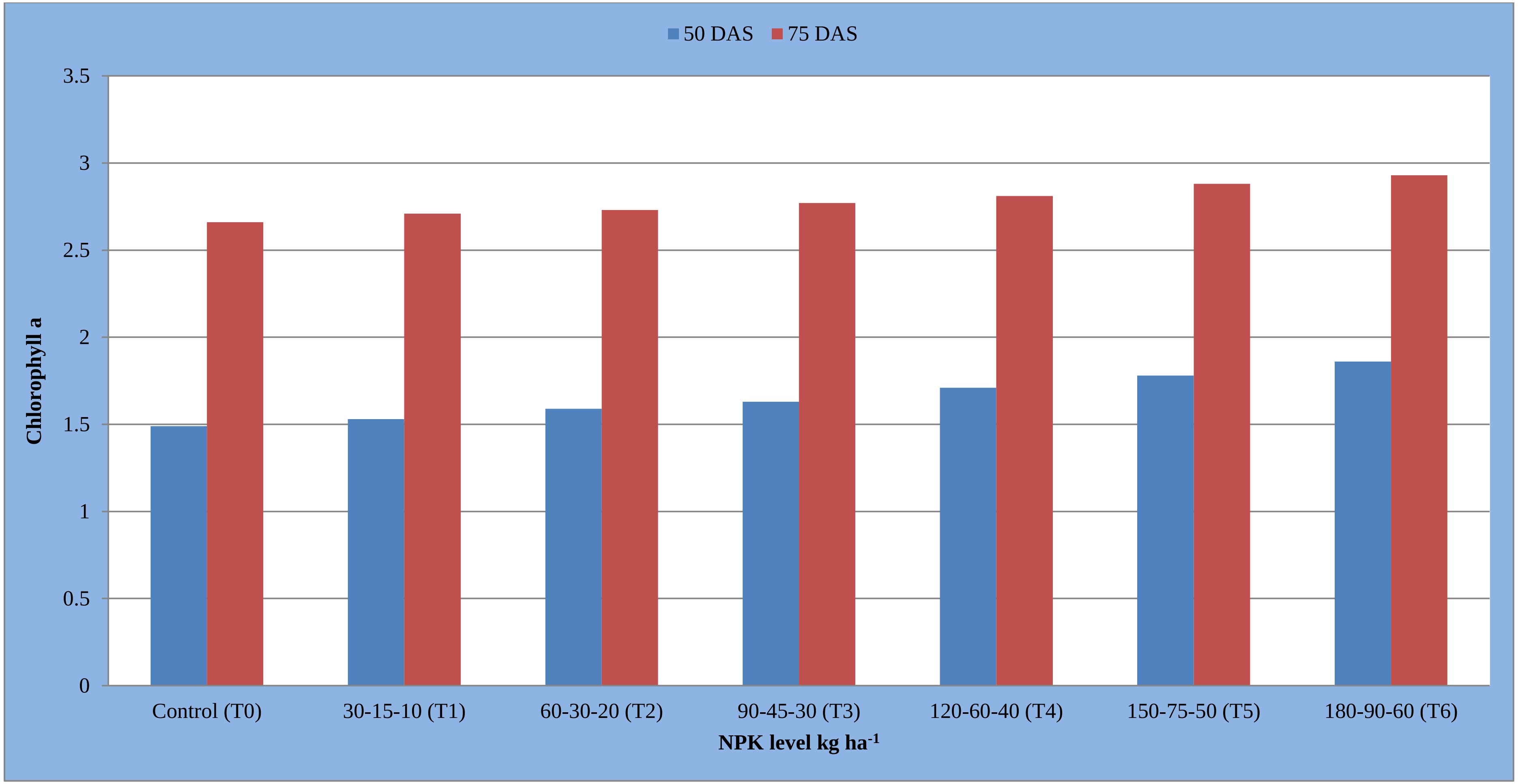
At 50 DAS the maximum chlorophyll a content was observed in NPK level (T_6) 180-90-60 kg ha^{-1} (1.86) which was significantly superior over the rest of the treatments, control (T_0) recorded lowest content and remained on par with NPK level (T_5) 150-75-50 kg ha^{-1} (1.78).

At 75 DAS, maximum chlorophyll a content (2.93) was recorded with application of NPK level (T_6) 180-90-60 kg ha^{-1} which was significantly superior over the rest of the treatments and remained on par with application of NPK level T_5: (2.88). Lowest level of chlorophyll a content noted in control (T_0).

Table 4.1.5: Effect of NPK levels on chlorophyll (a) content of late sown winter baby corn.

Treatments	**Chlorophyll a**	
	50 DAS	**75 DAS**
NPK levels (kg ha^{-1})		
T_0: Control	1.49	2.66
T_1: 30-15-10	1.53	2.71
T_2: 60-30-20	1.59	2.73
T_3: 90-45-30	1.63	2.77
T_4: 120-60-40	1.71	2.81
T_5: 150-75-50	1.78	2.88
T_6: 180-90-60	1.86	2.93
SEm ±	0.01	0.01
CD (P = 0.05)	0.04	0.05

Fig 4.1.5: Effect of NPK levels on chlorophyll (a) content of late sown winter baby corn.



4.1.6 Chlorophyll b

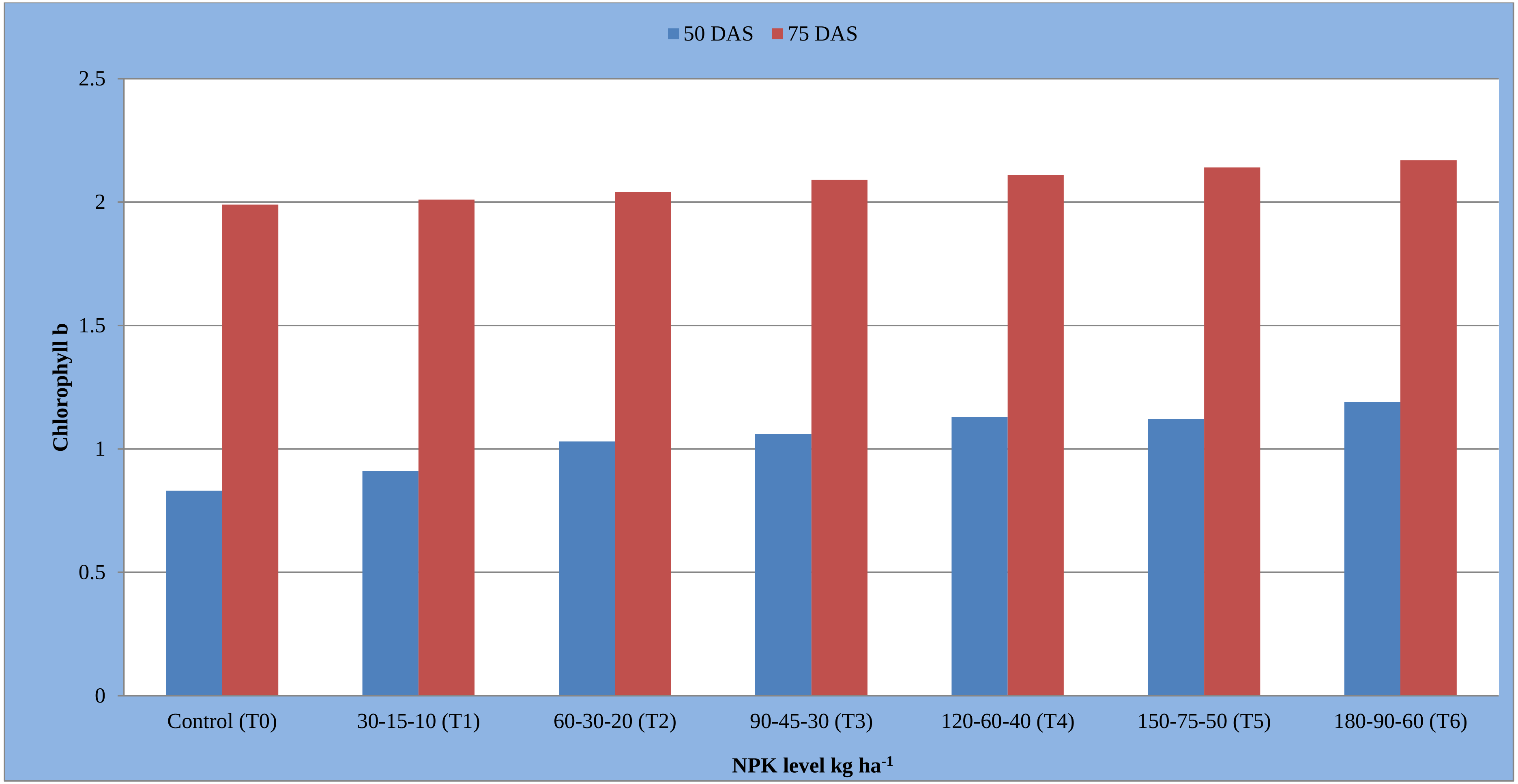
At 50 DAS, the maximum chlorophyll b content was observed due to NPK level (T_6) 180-90-60 kg ha^{-1} (1.19) which was significantly superior over the rest of the treatments and remained on par with application NPK level T_4: (1.13) and T_5: (1.12).The lowest content of chlorophyll b was recorded in control (T_0).

At 75 DAS, maximum chlorophyll b content (2.17) was recorded with application of (T_6) which was significantly superior over the rest of the treatments and remained on par with application of T_5: (2.14) to control (T_0).

Table 4.1.6: Effect of NPK levels on chlorophyll (b) content of late sown winter baby corn

Treatments	Chlorophyll b	
	50 DAS	**75 DAS**
NPK levels (kg ha^{-1})		
T_0: Control	0.83	1.99
T_1: 30-15-10	0.91	2.01
T_2: 60-30-20	1.03	2.04
T_3: 90-45-30	1.06	2.09
T_4: 120-60-40	1.13	2.11
T_5: 150-75-50	1.12	2.14
T_6: 180-90-60	1.19	2.17
SEm ±	0.02	0.01
CD (P = 0.05)	0.07	0.04

Fig. 4.1.6: Effect of NPK levels on chlorophyll (b) content of late sown winter baby corn.



4.2.1 Yield attributes

In this study about yield attributes of baby corn under different treatments of NPK levels are represented below:

4.2.1.1 First baby cob harvest (days)

The data on the first baby corn harvest as influenced by different NPK levels are presented in Table 4.2.1 and Fig. 4.2.l.

The number of days taken for harvest of first baby cob decreased with increase in the NPK levels however, the treatments failed to produce any significant difference.

4.2.1.2 Total harvest period of baby cob (days)

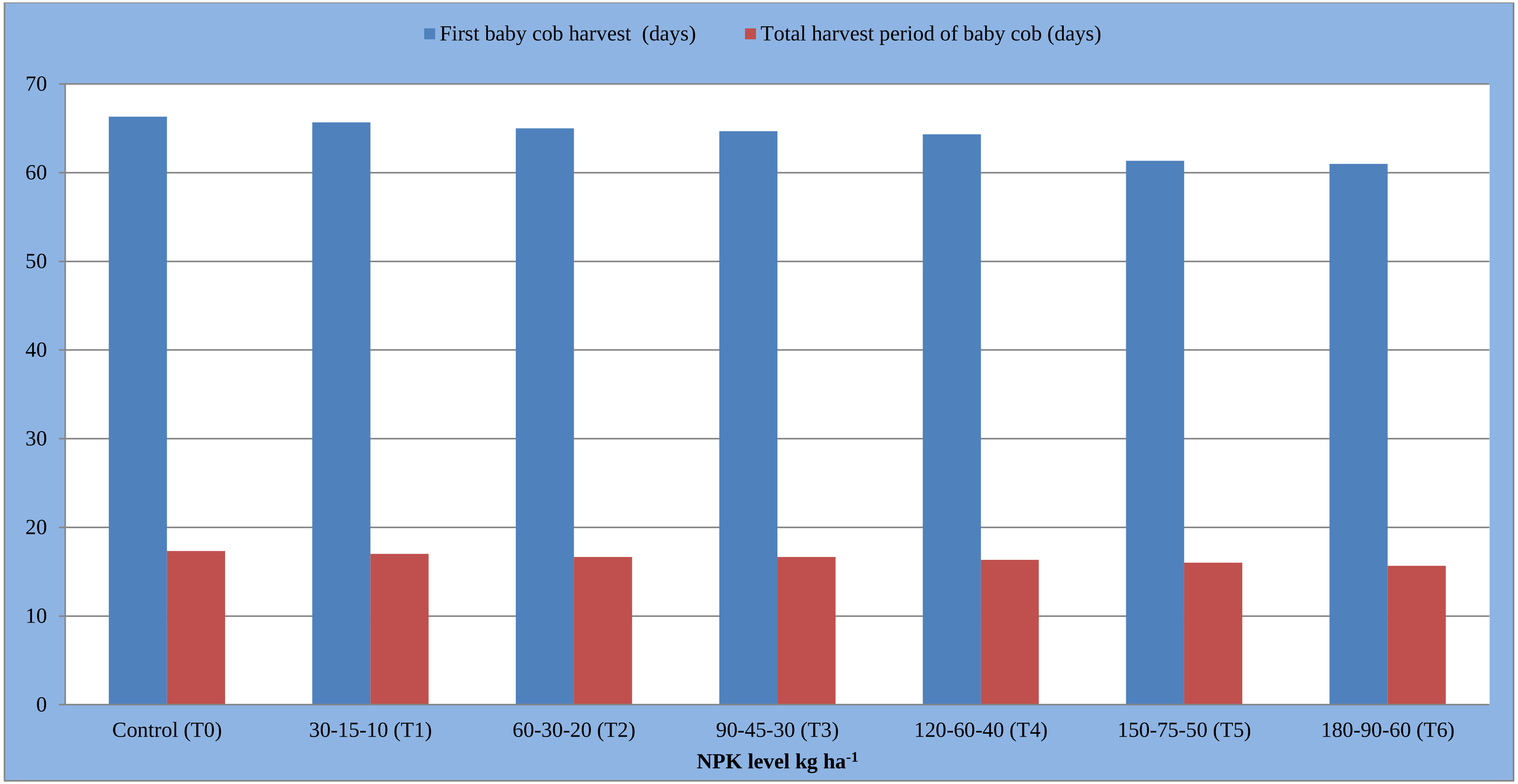
The effect of treatments are represented in Table 4.2.1 and Fig. 4.2.1.

Total harvest period reduced gradually with increase in the NPK level up to maximum. Minimum period of harvesting (15.67) was obtained with application of highest dose *i.e.*180-90-60 kg ha^{-1} (T_6). However, the variations were non-significant due to the treatments.

Table 4.2.1: Effect of NPK levels on first baby cob harvest (days) and total harvest period of baby cob (days) of late sown winter baby corn.

Treatments	First baby cob harvest (days)	Total harvest period of baby cob (days)
NPK levels (kg ha^{-1})		
T_0: Control	66.33	17.33
T_1: 30-15-10	65.67	17.00
T_2: 60-30-20	65.00	16.67
T_3: 90-45-30	64.67	16.67
T_4: 120-60-40	64.33	16.33
T_5: 150-75-50	61.33	16.00
T_6: 180-90-60	61.00	15.67
SEm±	2.66	0.60
CD (P = 0.05)	NS	NS

Fig. 4.2.1: Effect of NPK levels on first baby cob harvest (days) and total harvest period of baby cob (days) of late sown winter baby corn.



4.2.1.3 Number of baby cobs plant^{-1}

Different treatments and their effect of baby cobs plant^{-1} are presented in Table 4.2.2 and Fig. 4.2.2.

More number of baby cobs plant^{-1} (2.67) were obtained with the application of highest NPK level *i.e.*180-90-60 kg ha^{-1} (T_6) which was at par to T_5 (2.33), T_4 (2.00) and T_3 (2.00) although observed significantly superior over the treatments T_2, T_1 and T_0 (control).

4.2.1.4 Baby Corn Length (cm)

The effects of treatments consists various NPK levels are presented in Table 4.2.2 and Fig. 4.2.2.

Maximum baby corn length (9.41 cm) was obtained when highest NPK level (T_6) 180-90-60 kg ha^{-1} was applied which was significantly superior over all the lower levels except the treatment (T_5) 150-75-50 kg ha^{-1} (9.32 cm) which was noted at par. Minimum baby corn length was recorded with control (T_0).

4.2.1.5 Baby Corn Girth (cm)

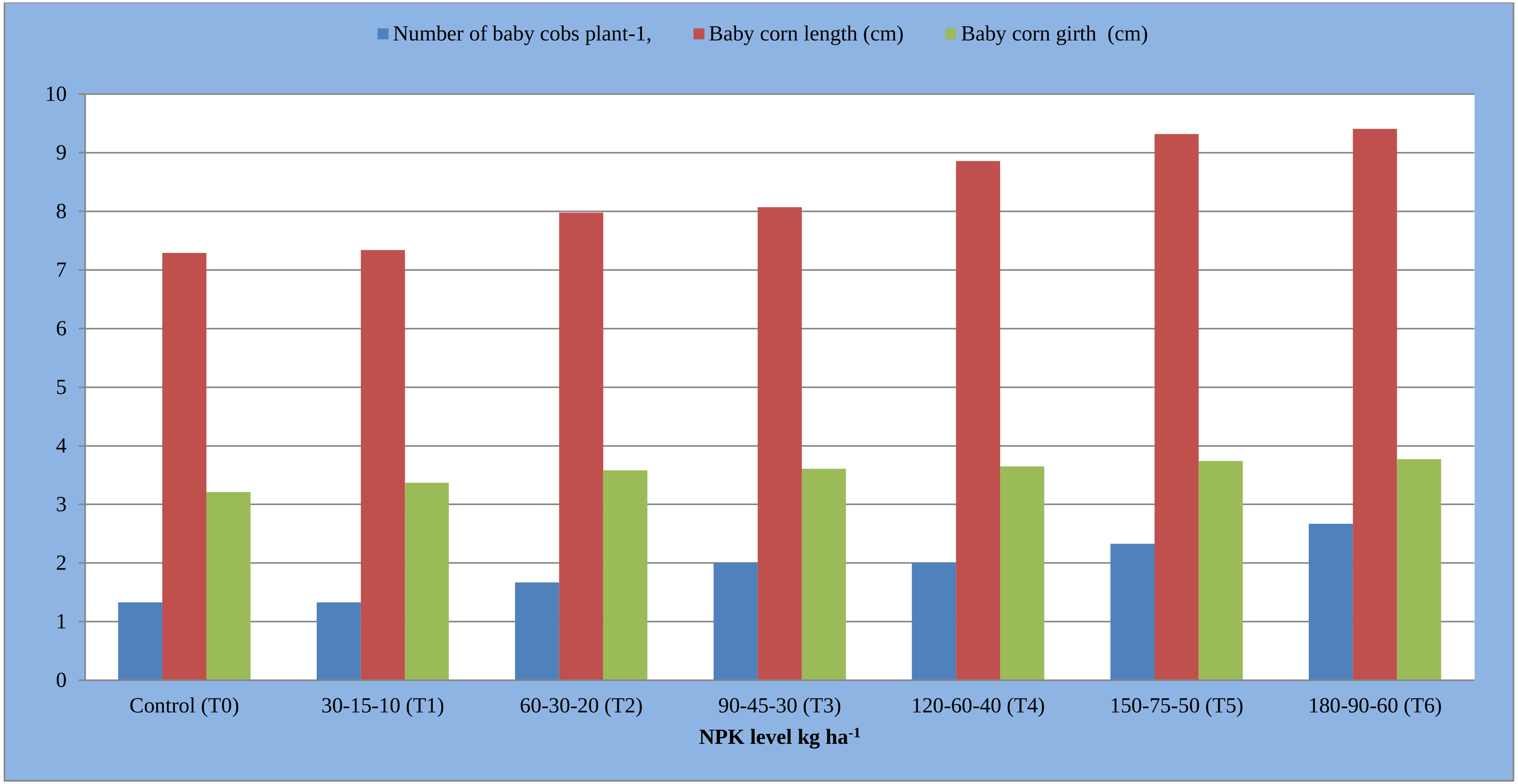
The effects of treatments which consists various NPK levels on baby corn girth are presented in Table 4.2.2 and Fig. 4.2.2.

Maximum baby corn girth (3.77 cm) was obtained with the application of highest NPK level (T_6) 180-90-60 kg ha^{-1} which was significantly superior over all other treatments. With each increment in NPK level over control treatment, the baby corn girth improved significantly

Table (4.2.2): Effect of NPK levels on number of baby cobs plant^{-1} baby corn length (cm) and baby corn girth (cm) of late sown winter baby corn.

Treatments	Number of baby cobs plant^{-1},	Baby corn length (cm)	Baby corn girth (cm)
NPK levels (kg ha^{-1})			
T_0: Control	1.33	7.29	3.21
T_1: 30-15-10	1.33	7.34	3.37
T_2: 60-30-20	1.67	7.98	3.58
T_3: 90-45-30	2.00	8.07	3.61
T_4: 120-60-40	2.00	8.86	3.65
T_5: 150-75-50	2.33	9.32	3.74
T_6: 180-90-60	2.67	9.41	3.77
SEm±	0.28	0.09	0.08
CD (P = 0.05)	0.85	0.27	0.25

Fig. 4.2.2: **Effect of NPK levels on number of baby cobs plant^{-1}, baby corn length (cm) and baby corn girth (cm) of late sown winter baby corn.**



4.2.1.6 Baby cob weight (g)

The effect of all treatments presented in Table 4.2.3 and Fig. 4.2.3.

Maximum baby cob weight (38.87 g) was obtained with the application of NPK level (T_6) 180-90-60 kg ha^{-1} which was statistically at par to T_5 (37.30 g) & T_4 (36.16 g), respectively though significantly superior over all other treatments *viz.* T_3, T_2, T_1 and T_0. The lowest cob weight was noted in control (T_0).

4.2.1.7 Baby corn weight (g)

The effects of treatments on baby corn weight are presented in Table 4.2.3 and Fig. 4.2.3.

Maximum baby corn weight (7.92 g) was obtained with the application of highest NPK level (T_6) 180-90-60 kg ha^{-1} which was significantly superior over all the treatments except (T_5) found at par. The lowest corn weight recorded with control (T_0).

4.2.1.8 Baby cob: Baby corn ratio

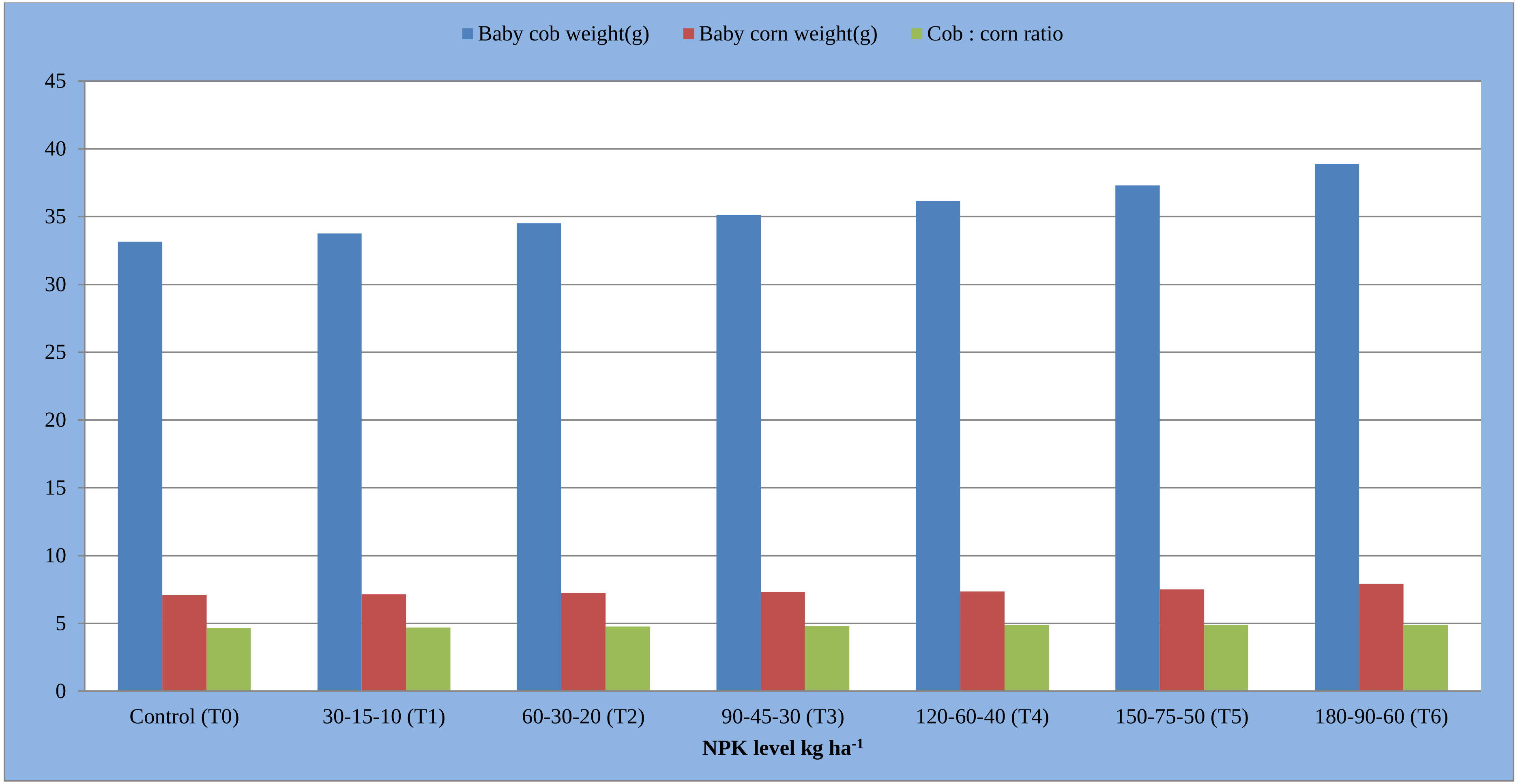
Different treatments of NPK levels and their effects are presented in Table 4.2.3 and Fig. 4.2.3.

The highest baby cob: baby corn ratio (4.91%) was obtained with the application of maximum NPK level (T_6). The cob: corn ratio did not vary due to treatments.

Table 4.2.3: Effect of NPK levels on baby cob weight (g), baby corn weight (g) and baby cob: baby corn ratio of late sown winter baby corn.

Treatments	Baby cob weight (g)	Baby corn weight (g)	Cob : corn ratio
NPK levels (kg ha^{-1})			
T_0: Control	33.14	7.10	4.66
T_1: 30-15-10	33.76	7.14	4.69
T_2: 60-30-20	34.50	7.24	4.76
T_3: 90-45-30	35.10	7.30	4.80
T_4: 120-60-40	36.16	7.36	4.89
T_5: 150-75-50	37.30	7.50	4.90
T_6: 180-90-60	38.87	7.92	4.91
SEm±	1.14	0.15	0.08
CD (P = 0.05)	3.47	0.45	NS

Fig. 4.2.3: Effect of NPK levels on baby cob weight (g), baby corn weight (g) and baby cob: baby corn ratio of late sown winter baby corn.



4.3.1 Yield

The data on baby cob yield (g), baby corn yield (g), and green fodder yield as influenced by the different treatments of NPK levels are presented in the 4.2.4 and Fig. 4.2.4.

4.3.1.1 Baby Cob Yield

The effect of treatments on baby cob yield is represented in Table 4.2.4 and Fig. 4.2.4.

Maximum baby cob yield (57.76 g plant^{-1}) was obtained with the application of NPK level (T_6) 180-90-60 kg ha^{-1} which was significantly superior over all other treatments except (T_5) (56.80 g plant^{-1}) which was found at par. The lowest baby cob yield was recorded by control (T_0).

4.3.1.2 Baby Corn Yield

Baby corn yield data are reported in Table 4.2.4 and Fig. 4.2.4.

Maximum baby corn yield (12.17 g plant^{-1}) was obtained with application of NPK level (T_6) 180-90-60 kg ha^{-1} statistically at par with (T_5) 150-75-50 kg ha^{-1} (11.92 g plant^{-1}) and (T_4) 120-60-40 kg ha^{-1} (10.77 g plant^{-1}) but was significantly superior over (T_3) 90-45-30 kg ha^{-1} (9.59 g plant^{-1}), T_2, T_1 and control (T_0) treatment on baby corn yield.

4.3.1.3 Green fodder Yield

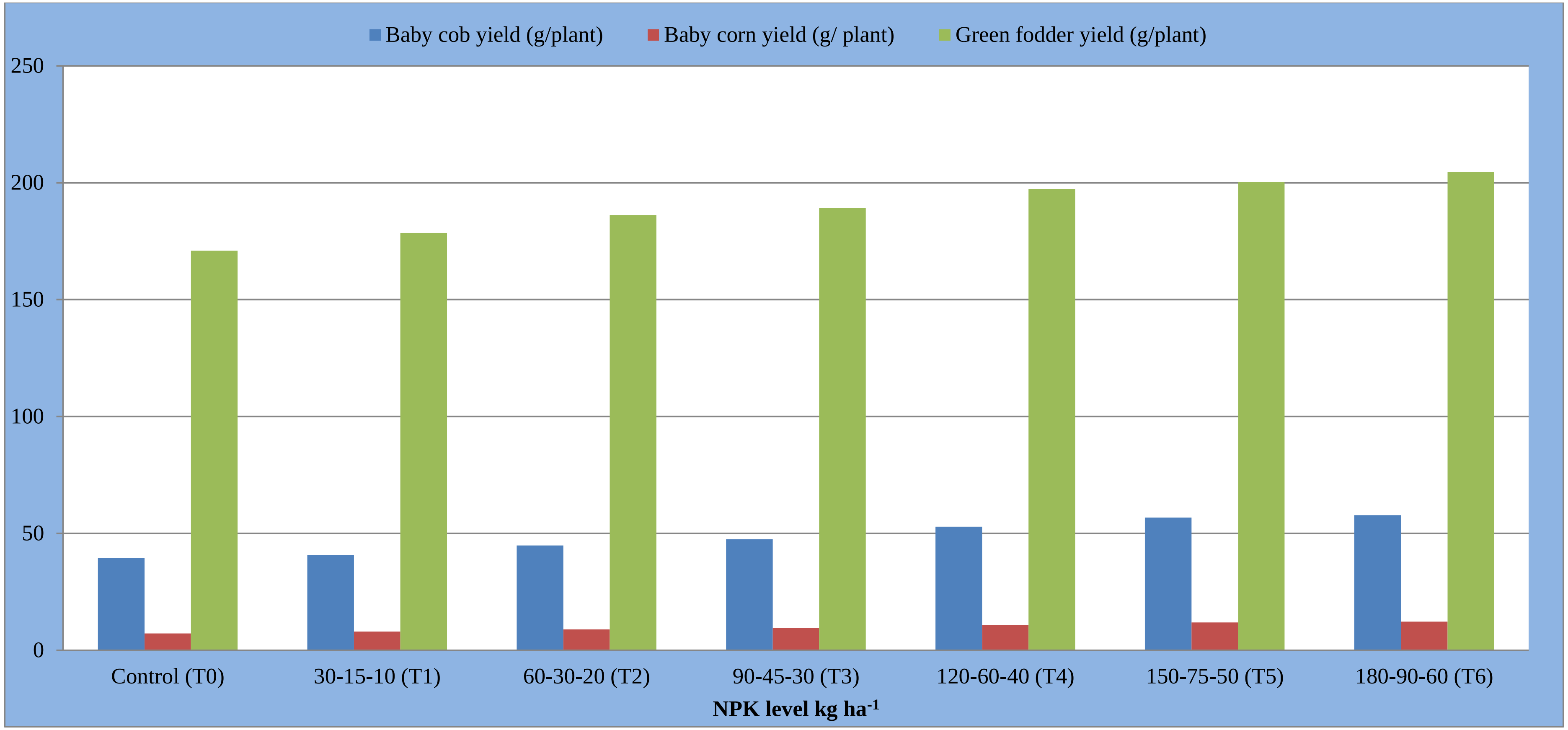
Effect on fodder yield by different treatments of NPK levels are represented by Table 4.2.4 and Fig. 4.2.4.

Maximum fodder yield (204.69 g plant^{-1}) was obtained with the application of NPK level (T_6) 180-90-60 kg ha^{-1} which was at par with (T_5) 150-75-50 kg ha^{-1} (201.37 g plant^{-1}) but significantly superior over rest treatments. Whereas, minimum green fodder yield was obtained in control (T_0).

Table 4.2.4: Effect of NPK levels on baby cob yield (g plant^{-1}), baby corn yield (g plant^{-1}) and green fodder yield (g plant^{-1}) of late sown winter baby corn.

Treatments	**Baby cob yield (g plant^{-1})**	**Baby corn yield (g plant^{-1})**	**Green fodder yield (g plant^{-1})**
NPK levels (kg ha^{-1})			
T_0: Control	39.54	7.20	170.95
T_1: 30-15-10	40.65	7.95	178.55
T_2: 60-30-20	44.77	8.94	186.16
T_3: 90-45-30	47.49	9.59	189.15
T_4: 120-60-40	52.85	10.77	197.38
T_5: 150-75-50	56.80	11.92	200.37
T_6: 180-90-60	57.76	12.17	204.69
SEm±	1.12	0.96	1.20
CD (P = 0.05)	3.39	2.92	4.64

Fig. 4.2.4: Effect of NPK levels on baby cob yield (g plant^{-1}), baby corn yield (g plant^{-1}) and green fodder yield (g plant^{-1}) of late sown winter baby corn.



Chapter V

DISCUSSION

The present study entitled **"Effect of NPK levels on growth and yield of late sown winter baby corn (***Zea mays* L.**)".** Was conducted during *rabi* season, 2021 at Agricultural Research Department of Rajiv Gandhi South Campus, BHU, Barkachha, Mirzapur, Uttar Pradesh. Growth and development of crop are dependent on crop genetic potential and environmental factors. Henceforth, growth and yield parameters of baby corn which are affected by different NPK levels are discussed in this chapter.

Specific climatic conditions are required for each crop for optimum growth and development. The major seasonal plants are grouped into two large groups *i.e.*, crop seeded at the start of the rainy season or monsoon *kharif* crop and crops planted in winter are known as *rabi* crops. As baby corn is a *rabi* crop, it responds better during October to March. Agricultural production is the consequence of an integrated interaction effect of the connection between soil-water-nutrient-climate with crop plants which usually requires wishful and scientific management of this complex system, which is crucial for improving crop productivity on a long-term basis.

Baby corn is a nitro-positive crop that indicates consumption of substantial amount of nitrogen for producing better plant growth and yield. As a consequence, it's essential to apply the appropriate amount of nitrogen at the correct time and to use the most efficient and effective administration strategy.

5.1 Effect of weather conditions.

Every crop requires and values a set of suitable meteorological conditions in order to accomplish optimal crop growth, development, and overall performance. Worthwhile, the climatic factors matching to crop phenology when prevails during the growing season, do help to exploit genetic potential of the crops. Vis-a-vis, if weather component gets fluctuated from their normal limits, simultaneously suppress the plants to achieve real expression of growth and yield.

Different factors, such as rainfall, temperature, relative humidity, duration of sunshine and evaporation, have been investigated in relation to the weather conditions during the current inquiry in Table (3.2) and Fig (3.2)

During sowing period, 9.7ºC and 23.7ºC are the mean minimum and maximum temperatures recorded. The maximum temperature was recorded during the 16th standard week (23-29 April) was 40^{o}C and during the 4th standard week (29 January-04 Feb.), lowest temperature was observed (8.6^{o}C). During the harvest period, the amount of precipitation was 1.7 mm *i.e.* during the 15th standard week (09-15April, 2021). Meteorological data recorded during the crop period is represented in Table 3.2 and Fig 3.2.

5.2 Effect of NPK levels on growth and yield of late sown winter baby corn.

Nitrogen is a primary essential element and a fundamental portion of amino acids, protein and nucleic acid building blocks, DNA and RNA. Substances such as nucleotides, amides and amines are a substance in plant compounds. It is crucial for the enzyme, biochemical and physiological responses of the plant metabolism and is an important part of photosynthesis as a structural component of the chlorophyll molecule (Rizwan *et al*., 2003) and (Saleem *et al*., 2009).

The plant growth requires phosphorus (P) and is found in all live plant cells. It participates in numerous important plant functions including energy transformation, photosynthesis, sugar and starch transformation, nutrient transport in the plant and genetic traits transmission from one generation to the next resulting in improved corn growth and yield. Transport of water, minerals and carbohydrates in the plant tissue involves another primary essential nutrient, potassium. This involves in activation of the enzymes in a plant that influences the synthesis of protein, starch and ATP (control the rate of photosynthesis).

The growth characters varied due to the influence of varying levels of NPK on baby corn *viz.* plant height, number of leaves plant^{-1}, dry weight plant^{-1}, leaf area plant^{-1}, chlorophyll a and b content are explained below.

5.2.1 Effect of NPK levels on growth characters of late sown winter baby corn

Nitrogen is one of the main elements that are responsible for plant growth. At all growth stages, the plant height increased with the improvement in the rate of NPK application to the highest level *i.e.* T_6:180-90-60 kg ha^{-1} however, it was found at par to T_5:150-75-50 kg ha^{-1} and T_4: 120-60-40 kg ha^{-1}. Similar response noted for number of leaves and dry weight plant^{-1}. However, leaf area plant^{-1} significantly improved due to maximum NPK application over other doses. Taller plants were attributed due to significant outcome of dry weight, leaf area plant^{-1} and number of leaves^{-1} also. This might be due to increase of nodes and internodes with increase in number of functional leaves the result obtained are in conformity with findings of (Kumar *et al.*, 2004), (Sharma *et al.*, 2000) and also the more availability of nutrients during crop growth period resulted in optimum cell division and stem elongation (Singh and Sarkar, 2001 and (Sharma *et al.*, 2000).

Plants capture sunlight during photosynthesis in which nitrogen plays a vital role as one of the main components of chlorophyll molecule therefore the highest NPK level *i.e.* (T_6) 180-90-60 kg ha^{-1} resulted in significantly higher chlorophyll a and b content in leaves of baby corn. Dry matter build-up is the consequence of the cumulative impact of all the characteristics of growth and with higher NPK levels. Similar results were noticed by (Zende *et al.*, 2006).

5.2.2 Effect of NPK levels on yield attributes and yields of late sown winter baby corn

As noticed in the preceding chapter, yield attributes and yield of different treatments of NPK levels on late sown winter baby corn *viz.* first baby cob harvest (days), total harvest period (days), baby corn length & baby corn girth (cm), number of baby cobs plant^{-1}, baby cob weight (g), baby corn weight (g), baby cob: corn ratio, baby cob and baby corn yield (g plant^{-1}), and fodder yield (g plant^{-1}) were markedly improved from control (0% NPK) to highest level (T_6:180-90-60 kg ha^{-1}).

The period of harvesting decreased with improvement in the levels of NPK and early first cob harvest registered with maximum level (T_6). Similarly total harvest period slightly prolonged with enhancement in the NPK doses. However, significant differences were not recorded because of lesser variability in the first cob harvest and the total harvest period. The cob: corn ratio also indicated the same pattern and the differences were non-significant. (Almaz *et al.,* 2017) and (Lone *et al.*, 2013) noticed substantial influence on baby cob length as a result of increased fertilizer levels. The cob weight in an investigation of (Bhushan and Khare, 2018) showed considerable variation with different levels of NPK. Marked outcome was observed in number of cobs plant^{-1}, baby corn length & girth. Results of yield and yield attribute shows profound influence of growth attributes. Better growth and development of plants ultimately produced superior yield parameters and finally the yield. It was also noted that baby cob & corn weight, baby cob & corn yield plant^{-1} and green fodder yield were significantly impacted by varying NPK levels and due to better crop development.

So, the abundance of nitrogen, phosphorus and potassium availability, increased rate of photosynthesis and their effective translocation for the development of reproductive parts were the reasons for better growth and development which in turn produced higher baby cob & corn yield plant^{-1}.

The results supported the findings of (Sahoo and Mahapatra, 2004), (Kar *et al.,* 2006), (Bindhani *et al.,* 2007), (Muthukumar *et al.,* 2005), (Ganesaraja *et al.,* 2009), (Singh *et al.,* 1985), (Thakur and Sharma, 1999).

Chapter VI

SUMMARY AND CONCLUSION

The study of experiment **"Effect of NPK levels on growth and yield of late sown winter baby corn (*Zea mays* L.)"**. The study was carried out at the Rajiv Gandhi South Campus, Banaras Hindu University, Barkachha in district of Mirzapur, Uttar Pradesh. The investigations were performed during *rabi* season in 2021. Important results of the experiment were presented below.

The experimental soil pH was 6.74 with sandy loam texture. The soil available nutrients *viz.* NPK (163.12, 20.34 and 230.47 kg ha^{-1}) exhibited low N and medium P & K but organic carbon (0.33%) was low. Complete randomized design (CRD) followed with seven treatments and replicated thrice.

The crop reaction to treatments was assessed by many descriptive and analytical parameters *viz.* plant height, number of leaves $plant^{-1}$, dry matter $plant^{-1}$, leaf area $plant^{-1}$ and chlorophyll a and b content, first cob harvest (days), total harvest period (days), baby corn length and girth (cm), number of baby cobs $plant^{-1}$, baby cob weight (g), baby corn weight (g), cob: corn ratio, baby cob and baby corn yield (g $plant^{-1}$), and green fodder yield (g $plant^{-1}$). In order to derive accurate findings, statistical analysis was carried out on the data acquired throughout the investigation. The various therapies have finally been examined. The key findings and general conclusions of the study are presented as follows.

- Highest plant height, number of leaves $plant^{-1}$, dry weight and leaf area $plant^{-1}$ was recorded by the application of (T_6) 180-90-60 kg ha^{-1} NPK and the lowest plant height was noticed in control (T_0).
- Highest chlorophyll (a) and chlorophyll (b) content was recorded with application of (T_6) 180-90-60 kg ha^{-1} NPK and lowest values were recorded with control (T_0).

- Initiation of baby cob harvest and the total harvest period did not affected significantly.
- The yield attributes *viz*. baby cobs plant^{-1}, baby corn length (cm), baby corn girth (cm), baby cob weight (g), baby corn weight (g) and baby cob: baby corn ratio was maximum with application of (T_6) 180-90-60 kg ha^{-1}.
- The baby cob: baby corn ratio was did not affected significantly.
- Application of (T_6) 180-90-60 kg ha^{-1} NPK gave highest baby cobs, baby corn and fodder yield than other treatments.

Recommendation

The results indicated that the application of fertilizer NPK dose @180-90-60 kg ha^{-1} produced highest baby corn and fodder yields of variety HIRA BSHM-21 grown during the winter season for Mirzapur region. However, economic basis should also be worked out. Further data is of one crop season therefore the validation needs further verification.

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