

## RESEARCH PROGRAMME

# **Effect of Spacing and different doses of nitrogen on Growth, Yield and Quality Parameters in Garlic [*Allium sativum* L.]**

By

Pardeep kumar

Regi. No. – 11614202

**M.Sc. Vegetable Science**

**Lovely Professional University**

**Phagwara (Punjab)**



**L** LOVELY  
**P** ROFESSIONAL  
**U** NIVERSITY

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## **CERTIFICATE**

Certified that this synopsis of Pardeep kumar, registration no. 11614202, entitled “**Effect of spacing and different doses of nitrogen on growth, yield and Quality Parameters in Garlic [*Allium sativum* L.]**” has been formulated and finalized by the student himself on the subject.

**(Signature of Student)**

**Pardeep kumar  
11614202**

**School of Agriculture,  
Lovely Professional University,  
Phagwara, Punjab**

**(Signature of Supervisor)**

**Dr. Sukhwinder Singh Aulakh  
UID-21621**

**School of Agriculture,  
Lovely Professional University,  
Phagwara, Punjab**

**(Signature of Co - Advisor)**

**Dr. Deepika Saxena  
UID- 20662**

**School of Agriculture,  
Lovely Professional University,  
Phagwara, Punjab**

**(Signature of Co- advisor)**

**Dr. Shailesh Kumar  
UID-19105**

**School of Agriculture,  
Lovely Professional University,  
Phagwara, Punjab**

## INTRODUCTION

Garlic (*Allium sativum* L.) belongs to the family Alliaceae and is the second most widely used *Allium* next to onion (**Hore J.K. et al., 2014**). *Allium* is the Latin word for garlic. It is part of a monocot genus of flowering plants frequently referred to as the onion genus. The genus includes approximately 500 species, including edible onions (*A. cepa*), garlics (*A. sativum*), shallots (*A. ascalonicum*), chives (*A. schoenoprasum*), and leeks (*A. porrum*) (**Nicastro H.L. et al., 2015**). Garlic crop originated from Central Asia and it spread to the other parts of the world through trade and colonisation (**Muneer N. et al., 2016**).

According to FAO (2012) Total cultivated area in the world was 1,199,929 ha with total production of 17,674,893 tones (**Mulatu A. et al., 2017**). India is the second major producing country of garlic having 2.01 lakh/ ha. area, 1058 lakh mt production and 5.27 t/ha productivity next after China. India exported 22665.99 mt. garlic amounting Rs. 3957.75 lakh during 2012- 13 (**Govind et al., 2015**).

It is primarily grown for its cloves, which are used mostly as food flavoring condiments due to groups of sulphur containing compounds, allin and alliin. Green tops are eaten fresh and cooked especially in tropical areas (**Alemu-Degwale, 2016**). It is consumed both fresh as well as in dried form as an important ingredient for flavouring various vegetarian and non-vegetarian dishes. In the Indian sub-continent fresh leaves of garlic used as salad and garlic cloves for pickling purpose. (**Gautam N. et al., 2014**).

Garlic has higher nutritive value as compared to other bulbous crops. It is a rich source of carbohydrates (29%), proteins (6.3%), minerals (0.3%) and essential oils (0.1-0.4 %) and also contains fat, vitamin C and sulphur (**Memane P.G. et al., 2008**). Content of ascorbic acid is very high in green garlic as compare to matured one. (**Gautam N. et al., 2014**).

Garlic is one of the important and widely cultivated spice crops used for food as well as medicinal purposes (**Alemu-Degwale, 2016**). It is widely used in Indian system of medicines (Ayurvedic, Unani and Siddha). Garlic possesses anti- microbial, anti- carcinogenic and antimutagenic properties. Garlic is reported to act as antioxidant. It also reduces the levels of lipids, cholesterol and sugar in blood due to presence of alliin (**Hore J.K. et al., 2014**).

Garlic has a medicinal value and helps to cure the blood pressure, heart diseases, cholesterol, cancer, common cold and plaque. In China has been successfully used in AIDs for the treatment of patients from cryptosporidium. Garlic also used as an insecticide and reduce cholesterol level in human blood and as a repulsive to snakes. It is beneficial to cardiovascular and immune system and has antioxidant and anticancer properties. Therefore its reputation as a medicine has increased to the extent that

capsules of garlic oil are marketed by health food stores and pharmacies as well. (**Gautam N. *et al.*, 2014**).

Allicin (diallylthiosulfinate) is the principal bio-active compound present in garlic extract which reduces level of blood cholesterol. Garlic has been considered as a rich source of carbohydrate, protein and phosphorus. Basically, garlic contains many effective compounds that exhibit antibiotic, antioxidant, anticoagulant, Hypocholesterolaemic, Hypoglycemic, hypertensive activities, platelet aggregation, antifungal and blood pressure lowering effect (**Govind *et al.*, 2015**).

Garlic yield is mostly depends on the number of plants per unit area. Increase in yield and for bulb grade improvement planting of garlic at proper spacing is considered as necessary practice. An improper and inadequate agronomic practice leads to lower productivity in garlic. Planting density has an important part in deciding the crop yield. In recent ears economic importance of the garlic has increased considerably in the entire world. The sowing date and planting density considered as important management practices in garlic production. Garlic production and bulb yield could be improved through application of manures and proper spacing (**Muneer N. *et al.*, 2016**).

Gibberellin, one of the important plant bio-regulators plays a major role in growth of plants including development of seed, organ elongation, senescence as well as control the time of flowering. Considerable amount of vitamins, essential oils, amino acids, growth regulators like IAA, GA, macro and micro nutrients are in liquid manure as well as in some biodynamic preparations like-Panchagavya, Jeevamruth and Beejamruth. The liquid manure made from the natural sources is eco-friendly and gives sufficient nutrition for the plants without bad side effects for the crops or human beings (**Govind *et al.*, 2015**).

Different types of soils have different characteristics that influence growth and yield of crops. Both macro and micro-nutrients have various levels of availability in different soils and their removal by different crops varies at different seasons and areas. **Kakara *et al.*, (2002)** reported that N accounts for a higher percentage of variation in plant height, leaf area, leaf count, and fresh and dry plant mass when its application increased from 50 to 200 kg ha<sup>-1</sup>.

Application of balanced fertilizer is necessary for the vegetative growth and for producing crop with top quality and high yield especially in continuously cultivated. Improved management of nitrogen, phosphorus, potassium and other inputs in the soil leads to improvement in vegetables and in other crop in relation to yields and quality. (**Nai-hua *et al.*, 1998**). Were studied that balance supply of N, P and K should base on the fertilizers management practices as well that other nutrients based on result of soil test (**Diriba S. *et al.*, 2013**).

Due allelopathic and antimicrobial effects of garlic, it has been effectively incorporated into an intercropping system as a companion crop. Some studies have reported that garlic as intercrop can prevent insect attack and weeds. Recent research results that intercropping with garlic, green garlic (planting whole bulbs and cutting green garlic more than once) and onion can alleviate the problems related with continuous cropping (soil sickness) in cucumbers under protected cultivation (**Xiao X. *et al.*, 2013**).

The research is totally based on the efficient use of fertilizer and land. This study will help the farmer to save their money by adopting the proper dose fertilizer, which are applied in very huge amount by the farmers of Punjab state. This will also help to land use of the farmer by adopting the proper spacing to gain maximum yield per hectare.

**Objectives of the research:**

1. To study the effect of plant spacing on different morphological traits of garlic
2. To study the effect of plant spacing on yield and quality traits of garlic
3. To study the effect of different doses of fertilisers on morphological traits of garlic
4. To study the effect of different doses of nitrogen on yield and quality traits of garlic

## REVIEW OF LITRETURE

### Effect of Spacing:-

**Nagina Munger *et al.*, (2017)** Were concentrated on those impact about planting density for growth, quality and yield of garlic. The treatments were completely In light of plant to plant distance( 3, 5, 7, 9 ,11cm) row to row (12, 14 and 16cm). Plant spacing 5cm and 11 cm comes about critical impact to leaf area, leaf length, plant height, bulb size, new weight for bulb, dry weight for bulb, number about cloves for bulb and yield for /ha. As contrast with different medicine for 14 cm column dividing demonstrated best critical impact once All the more leaf beet area, leaf beet length, knob size, new weight of bulb, dry weight from claiming bulb, amount for cloves knob Furthermore yield for every /ha. Gaspig thickness influences those Growth, nature Furthermore yield from claiming garlic, plant dividing of 5 cm Also 11 cm with row spacing from 14 cm demonstrated ideal.

**Mengesha W. and Tesfaye A. (2015)** A field analyze might have been led should focus those ideal planting density for abating garlic rust so as should boost yield about garlic. Under those analysis incorporate three level from claiming intra-row spacing 10 cm, 15 cm and 20 cm. The effect demonstrated that those dividing might have been differed essentially Previously, malady occurrence Furthermore seriousness and done previously agronomic data. Those greatest yield might have been watched from plot planted with 10 cm intra column spacing the place might have been those least esteem of yield might have been recorded at plot planted for 20 intra column dividing. In view of the effects obtained, it Might be inferred that dividing 10cmx30cm is ideal to preferred handling of garlic under disease condation.

**Doro A.K. (2012)** A trial might have been led to in garlic to yield reactions for garlic should fluctuating intra-row spacing. There were aggregate four intra-row spacings (5, 10, 15 and 20cm) in treatments. Spacing about 5 should 20cm demonstrated expanded huge outcomes to know yield helping qualities but to yield from claiming cured bulb (t/ha) dependent upon the results, it might have been reasoned that those variety Ex-Sokoto ought further bolstering be embraced to ideal bulb yield (t/ha) for garlic, those intra-row spacings from claiming 5cm.

**Dhakulkar N.D. *et al.*, (2009)** Field analyze were led clinched alongside garlic on study the impact about spacing and clove span with respect to yield. The comes about indicated that most highest yield might have been recorded for closer spacing (10 x 10 cm) However, the production of quality bulb might have been watched under wider dividing (15 x 15 cm). Similarly moderate clove extent provided for most elevated yield, Likewise moderate clove size gave highest yield, whereas larger clove size leads to production of quality bulbs.

**Naruka I.S. and Dhaka R.S. (2001)** A trial might have been led on study those impact about row spacing and nitrogen fertilizers around growth, yield and arrangement about bulb in garlic. increase in application of nitrogen and row spacing, outcomes for expand On bulb yield and also On the whole development and yield attributing qualities. T.S.S. observed highest in closer spacing. Jajavar local variety was significantly superior then two cultivar in growth and yield characters. The cultivar Jajavar local gave highest bulb yield, highest net returns and B:C ratio with combination of Nitrogen 200 kg/ha and row spacing of 15 cm.

### **Effect of Nitrogen:-**

**Maryam Nori *et al.*, (2012)** Impact for different sources and levels about nitrogen fertilizer were examined done analyze which demonstrated critical impact from claiming nitrogen with respect to nitrates. Nitrate fixation of nitrate expanded for expanding levels of fertilizer. Impact of fertilizer might have been not altogether outcomes once yield and toward expanding the measure about fertilizer on expansion those yield about 200 kg/ha. In the treatment from claiming urea (100 kg) those most reduced concentration(1/407 mm g dry weight) might have been observed, while most noteworthy quality about nitrate fixation (9/640 mm g dry weight) watched for 300 kg.

**El-Shal, Z.S. *et al.*, (2011)** Were contemplated those impact for 3 plant densities Also 3 NPK compost rates once garlic plant growth characters, head yield and its a portion physical properties and chemical constituents of garlic cloves . Outcome demonstrated that those close spacing picked up those briefest plant height, which conveyed the less spacing amount also less new dry weight for entirety garlic plant and its diverse organs. The heaviest aggregate garlic yield with those most reduced bulb breadth Also most reduced qualities from protein, N, P, K, Fe, Mn, Zn and Cu, the sum of them recorded for end plant densities. Expanding NPK rate for garlic developing came about those vigor plant growth, the heaviest tonnage obligation yield, the most elevated garlic leader and the most note worthy dietary values in compared for the most reduced NPK rates. Those heaviest garlic yield picked up with close plant spacing and applying the most noteworthy NPK rate, yet the least dietary components vales recorded with end plant dividing Furthermore no NPK expansion.

**Farooqui M.A. *et al.*, (2009)** Were concentrated on the impact for different level for sulphur with respect to garlic should improve those benefit. Top dressing might have been done with basal measurements about 4 levels of nitrogen and sulphur microbes. Provision of nitrogen (200 kg/ha) and sulphur microbes attempted (60 kg/ha) altogether expanded those plant height, number of leaves for every plant, number of cloves for every bulb and similarly indicated best effects As far as development Furthermore yield qualities. Different. Around the sum medicine combinations (200 kg

n ha + 60 kg encountered with urban decay because of deindustrialization, innovation developed and demonstrated higher yield.

Nitrogen need been recognized Concerning restricting supplement of nutrients over development about plant. Plants absorb nitrogen Similarly as cations (NH<sub>4</sub><sup>+</sup>) alternately anions (NO<sub>3</sub><sup>-</sup>). Through diverse sources plants acquire lot about accessible N. The significant manifestations incorporates diverse living nitrogen settling microorganisms, mineralization process, modern nitrogen gas obsession and nitrogen oxides obsession directed Toward climatic electrical release. Similarly, natural Also inorganic nitrogen mineralization specifically relies looking into temperature, level from soil dampness and supply for oxygen. (Tisdale *et al.*, 1995; Miller and Donanue, 1995).

**Raghu *et al.*, (2012)**Garlic holds show about organosulfur mixes Also principally utilized for treating large portions ailments including cardiovascular problems, contagious contamination ,common frosty and brain tumor. Numbers of epidemiological proofs report those gainful impacts from bioactive organosulfur exacerbates of garlic against growth. Those real anti-carcinogenic components need aid caspase indigent alternately free incitement from apoptosis, anti-proliferative, anti-metastasis, anti-oxidant also resistant modulative properties. On the support from claiming clinical trials garlic utilization about 20 g/day cures those colorectal growth and diminished those gastric hazard. Concerning illustration an aftereffect expanded uptake about garlic might keep those digestive tumors frequency.

**Bordia *et al.*, (1975)** The hyperlipemia impact might have been prompted over onion Also garlic towards nourishing 100 g spread Furthermore it need been mulled over done 10 healthy subjects. 50g about newly concentrated juice for onion or garlic, and in addition a equivalent add up about their ether-extracted key oils, might have been administered haphazardly On a one- week period around four separate times. Subsequently it is closed that those key oils were the animated standard from garlic Also onion. Which synthetically will be An blending from claiming sulphur-containing compounds, primarily allyl propyl disulphide and diallyl disulphide.

**Stankovic *et al.*, (2007)** Were contemplated the forty-one field sample about onion and garlic wilted plants in Serbia, predominant contagious species *F. Proliferatum* might have been disengaged from bulbs Also bases. Seventy segregates were firstly portrayed to their sexual ripeness and demonstrated will a chance to be mostaccioli parts about *Gibberella intermedia*. Those sexual phase of *f. Six* of the eleven detaches about *f. Proliferatum* handled fumonisin B1 starting with 25 should 3000 µg g<sup>-1</sup>, Also beauvericin from 400 on 550 µg g<sup>-1</sup>; ten segregates handled fusaric corrosive starting with 80 with 950 µg g<sup>-1</sup> and moniliformin from 50 should 520 µg g<sup>-1</sup>. Finally the sum detaches processed fusaproliferin dependent upon 400 µg g<sup>-1</sup>. Comes about for al segregates confirms *f. Proliferatum*



Likewise a critical pathogen from claiming onion Also garlic, and an potential mycotoxin accumulation hazard to defiled plants of both garlic also onion.

**Jabar et al. (2007)** *Allium sativum* Holds large portions restorative properties such as antimicrobial, antineoplastic, immuno-stimulatory, hypoglycaemic exercises and anticardiovascular,. Allicin will be those significant segment for garlic which is responsible for antimicrobial action and quickly synthesised Eventually its precursor when garlic is crushed. This analyze assesses the antibacterial potentiality of garlic utilizing up to date microplate-based antibacterial assays. Screening for garlic may be to assessing those potency for crude garlic juice, Different extracts (n-hexane, dichloromethane, methanol and water) and commercial preparation about garlic were screened.

**Stanacev et al., (2011)** Were analyzed the impacts of garlic (*Allium sativum* l. ) and copper independently. Combined effects on the carcass quality in broiler chicks and processing parameters. The testing might have been conveyed out under protective states for one-day-old hubbard broilers of same weight isolated in four groups, every comprising about 75 birds, to 4 repetitions. Treatment bunches were given: 2% of commercial garlic in group II, 2% garlic Also 100 ppm copper for aggregation III, 100 ppm Copper in group IV. Toward those limit of the analyze which kept ticking forty two days it might have been discovered that s were as about garlic prompted An noteworthy expand of constitution impostor to group II and group III in examination of the control aggregation. The feed exploitation was found to be better in groups treated with garlic.

## MATERIAL AND METHODS

**EXPERIMENT SITE:** The experiment will be conducted at Main Experimental Farm, Lovely Professional University Phagwara (Jalandhar) during Aug-Nov.

**EXPERIMENTAL MATERIAL:** Two different spacing (15 x 10 cm and 20 x 10 cm) and three different doses of nitrogenous fertilisers (50 kg/ha, 100 kg/ha and 150 kg/ha) treatments will be used with two replication by using single variety as experimental material.

Treatment	Spacing	Subplot treatment	Fertiliser (Kg/ha)
T <sub>1</sub>	Normal spacing (15 x 10 cm)	T <sub>1</sub> S <sub>1</sub>	50
		T <sub>1</sub> S <sub>2</sub>	100
		T <sub>1</sub> S <sub>3</sub>	150
T <sub>2</sub>	Wider spacing (20 x 10 cm)	T <sub>2</sub> S <sub>1</sub>	50
		T <sub>2</sub> S <sub>2</sub>	100
		T <sub>2</sub> S <sub>3</sub>	150

**LOCATION OF FIELD** – Geographically it is situated 31.13 N and 75.47 E at an average elevation of 234 m near the Mount Everest under the belt of River Ganga.

**CLIMATE and SOIL** - The annual temperature is 24.1 °C and highest temperature 43.6 °C in the month of July and lowest in month of January i.e. 6.2 °C. The soil is loamy in nature, well drained and highly fertile with annual rainfall 686 m throughout the year.

### OBSERVATION TO BE RECORDED

Morphological data will be observed for the several characters which are as follows-

- i. Plant height
- ii. Number of leaves per plant
- iii. Fresh weight of leaves
- iv. Maturity period
- v. Neck thickness of bulb
- vi. Bulb diameter
- vii. Fresh weight of bulb
- viii. Number of cloves per bulb
- ix. Weight of 20 cloves
- x. Bulb yield
- xi. Harvest index

Quality parameters

TSS (Total Soluble Solids)

## **STATISTICAL ANALYSIS**

Statistical analysis:-

- I. Analysis of variance (ANOVA) in Randomized Block Design.
- II. Correlation analysis
- III. For quality parameter, TSS analysis by using refractometer.

## WORKING SCHEDULE :-

- Field preparation:- 12 October, 2017
  - Standard agronomical practices were adopted. Raised bed was prepared for sowing.
- Date of sowing:- 14 October, 2017
  - Cloves were sown in line sowing on the raised bed.
- Variety:- Pb - 18
  - It has dark green leaves and bulbs are attractive and white in colour. The Cloves are white in colour and no. of cloves vary from 25-30 per bulb. It mature in 165-170 days and total yield is 50 q/acre.
- Spacing :-
  - T1 - 15×10
  - T2 – 20×10
- Fertilizer application:-

<b>Fertilizer</b>	<b>S1 (kg/ha)</b>	<b>S2 (kg/ha)</b>	<b>S3 (kg/ha)</b>
<b>Nitrogen</b>	50	100	150
<b>Phosphorus</b>	50	50	50
<b>Potassium</b>	50	50	50

- Irrigation :-
  - Irrigation required at a regular interval of 10-12 days. First irrigation is applied immediately after time of dibbling. Irrigation schedule may be change according to the environmental condition.
- Weeding :-
  - Hand weeding was done 2 times.

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