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## Evaluation of Garlic (*Allium sativum* L.) germplasms for yield potential and quality characters under Allahabad agro-climatic conditions

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### Abstract

The present experiment was conducted at the Research Farm, Department of Horticulture, Sam Higginbottom Institute of Agriculture, Technology and Sciences, Allahabad during the winter (Rabi) season to critically evaluate eighteen varieties for future breeding programme in garlic in growth and yielding character. The 100% germination was recorded in Variety Yamuna Safed-1 (G-1), Yamuna Safed-3 (G-282), Yamuna Safed-2 (G-50), Yamuna Safed-4 (G-323) and lowest recorded Madrasi Local. The earliest germination was recorded in Yamuna Safed-3 (G-282) whereas; Madrasi Local variety took maximum time for germination. Yamuna Safed-3 (G-282) recorded maximum plant height and number of leaf sheaths per plant at all the successive stages of growth and the minimum was found with Madrasi Local variety. Minimum incidence of insect, pests and diseases percentage was recorded in Yamuna Safed-3 (G-282) while the maximum was recorded with Madrasi Local variety. Maximum fresh weight of bulb, number of cloves per bulb, length, width and weight of individual cloves, and bulb yield per hectare was recorded with Yamuna Safed-3 (G-282) and the minimum remained with Madrasi Local variety.

**Keywords:** Garlic, Plant height, germination, bulb yield

### Introduction

Garlic (*Allium sativum* L.) is one of the important spice crops grown in our country, next to onion. It belongs to the family Alliaceae. The native place of garlic is said to be Central Asia and Southern Europe, especially the Mediterranean region (Singh *et al.*, 2002) [16]. This crop is grown as spice and condiment, though it is treated as a maligned vegetable in India, due to its undesired flavour. It is grown for medicinal usage in pharmaceutical industry also. It is a herbaceous annual, the underground edible stem of which is a composite bulb made up of a numerous smaller bulbs known as cloves, covered with pinkish or whitish skin. The number of cloves varies from 6 to 50, depending upon the genetic and agronomical situations (Bhatt *et al.*, 2017) [3]. India ranks second after China in area (247.52 thousand hectare) and second in production (1259.27 thousand tonnes) of garlic with an average productivity of 5.09 tonnes per hectare (Gupta, 2014) [5]. Garlic is grown as a winter crop in Gujarat, Madhya Pradesh, Rajasthan, Maharashtra and Uttar Pradesh, Among the major vegetable crops cultivated in Uttar Pradesh, garlic occupies an area of 15,147 hectares with total annual production of 78,614 tonnes and in India, area under production of garlic bulbs is reported to be around 118,800 hectares with total annual production of 4, 95,000 tonnes Anonymous (2014) [1]. Garlic is a frost-hardy bulbous perennial erect herb of 30-100 cm in height with narrow flat leaves and bears small white flowers and bulbils. It is used in pickles, curry powder, curried vegetables, mean preparation, tomato ketchup, etc. In the Philippines, Central Eastern Asia and in parts of the tropics, the green tops as well as bulbs of garlic are used. Dehydrated garlic in powdered or granulated form has replaced the use of fresh bulbs for industrial and home use in many countries Vatsyayan *et al.* (2014) [20].

Garlic's have been cultivated for thousands of years for therapeutic and prophylactic properties, religious significance, and flavour and taste. Garlic has higher nutritive value than other bulb crops. A fresh peeled garlic clove contains moisture (62.8%), protein (6.3%), fat (0.1%), minerals (1.0%), fibre (0.8%), carbohydrate (29%), calcium (0.03%), phosphorus (0.31%), iron (0.001%), nicotinic acid (0.4 mg/100g) and vitamin C (13 mg/100g) Natale *et al.* (2005) [13].

### Materials and Methods

The present experiment was conducted at the Research Farm, Department of Horticulture, Sam

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Higginbottom Institute of Agriculture, Technology and Sciences, Allahabad during the winter (Rabi) season to critically evaluate eighteen varieties for future breeding programme in garlic in growth and yielding character. The field trial was laid in randomized block design (R. B. D.) having a total of eighteen genotypes [Yamuna Safed-1 (G-1), Yamuna Safed-2 (G-50), Yamuna Safed-3 (G-282), Sweta (Selection – 10), Godawari (Selection-2), Yamuna Safed-4 (G-323), Local Collection Newada Kaushambi, Local Collection, Soraon, Allahabad, Local Collection, Fatehpur Mandi, Local Collection, Pratapgarh, Local Collection, Varanasi, Local Collection, Adalpura, Varanasi, Local Collection, Koraon, Allahabad, Local Collection, Kaushambi, Local Collection, Gyanpur, SRD Nagar, NHRDF-1, Deoria, Madrasi – Local and Tabiti – Local], each replicated three times. The allocation of treatments to the individual plots was done using random numbers in each replication. Each genotype was assigned to six rows per plot with a distance of 20 cm line to line and 15 cm plant to plant. The five randomly selected plants in each genotypes of all replication were utilized for taking the observation at appropriate stage. The experimental field was prepared by deep ploughing followed by two cross harrowing and planking. The field was thoroughly leveled by a leveler before it was laid out. Organic manure (FYM) and fertilizers were applied according to recommended doses for garlic i.e. 15 t/ha FYM alongwith fertilizers N : P<sub>2</sub>O<sub>5</sub> : K<sub>2</sub>O @ 100 : 50 : 50 kg/ha. Nitrogen (N) was applied in three splits. FYM was mixed alongwith half of the dose of nitrogen, total phosphorus and potash and applied as basal dressing before planting. Balance quantity of N was top dressed in two split doses of one-fourth each at 45 and 75 days after planting. The experimental crop was grown in winter season. Whenever a moisture stress was noticed, irrigation was given. Dithane M-45 @ 1% per litre of water was sprayed in the plots at 27 and 47 DAS, to protect the Garlic bulbs were manually harvested on March.

### Results and discussion

Significant variations were observed for different characters. The mean performance of different genotypes for growth and yield attributing characters are presented in Table 1 and 2. At the starting of the research work in research field we found that the cloves of garlic have some variance in germination. After data analysis we observed that the germination percentage of garlic cloves was differing in different genotypes in Allahabad agro-climatic conditions. The germination percentage ranged from 69.00 to 100 with overall genotypes. Variety Yamuna Safed-1 (G-1), Yamuna Safed-3 (G-282), Yamuna Safed-2 (G-50), Yamuna Safed-4 (G-323) and Tabiti Local recorded 100% germination followed by Local Collection, Newada Kaushambi, whereas, the minimum was recorded with Madrasi Local during the experimentation. These results are in agreement with findings of Memane *et al.* (2008) [11] and Lawande *et al.* (2009) [9]. Germination percentage of garlic clove after sowing according to data analysis the earliest germination (6 days) was observed in Variety Yamuna Safed-3 followed by (7 days) in Yamuna Safed-2, while the maximum time for germination (12 days) was observed in Madrasi Local variety and NHRDF - 1, Deoria followed by (11days) in Local Collection, Kaushambi. At 20 days after germination of garlic cloves the maximum plant height height (16.53cm) was recorded in genotype Yamuna Safed-3 (G-282) followed by Yamuna Safed - 1 (G-1) 16.50cm. The lowest plant height was recorded (13.13cm) in Madrasi Local followed by NHRDF - 1, Deoria (13.20cm)

and Local Collection, Gyanpur, SRD Nagar (13.50cm). At 120 days after germination of garlic cloves the maximum plant height height (62.40) was recorded in genotype Yamuna Safed-3 (G-282) followed by Yamuna Safed - 1 (G-1) 60.15cm. The lowest plant height was recorded (54.77) in Madrasi Local followed by NHRDF - 1, Deoria (56.00cm) and Local Collection, Gyanpur, SRD Nagar (56.08cm). These results are in agreement with findings of Tiwari *et al.* (2002) [19] and Futane *et al.* (2006) [4] who evaluated the performance of garlic genotypes for plant height. In case of incidence of insect, pests and diseases percentage in garlic plants recorded that the Minimum incidence of insect, pests and diseases percentage was recorded in Yamuna Safed-3 (G-282) 30.20% followed by Yamuna Safed - 1 (G-1) 30.25% while the maximum was recorded with (41.50%) in Madrasi Local followed by NHRDF - 1, Deoria (40.60%) and Local Collection, Gyanpur, SRD Nagar (40.35%). The results are in agreement with the finding of Mehra and Batra (2005) [10]; Suberi and Price (2000) [18]; Harris *et al.* (2001) [6]. On the basis of mean performance of garlic genotypes for yield characters under Allahabad agro-climatic conditions. The maximum fresh weight of garlic bulb was recorded with Yamuna Safed-3 (G-282) 39.18g followed by Yamuna Safed-1 (G-1) (38.29g) and the minimum remained with Madrasi Local variety (15.20g). Similar result have been reported by Khar *et al.* (2004) [7]; Singh and Chand, (2003) [17].

The same trend was found in number of cloves per bulb. The maximum number of cloves per bulb was recorded with Yamuna Safed-3 (G-282) (21.48) followed by Yamuna Safed-1 (G-1) (21.11) and the minimum remained with Madrasi Local variety (14.76). After data analysis of the length of garlic clove in centimeter we observed that the maximum length garlic clove was recorded with Yamuna Safed-3 (G-282) 2.93cm followed by Yamuna Safed-1 (G-1) 2.90cm and the minimum remained with Madrasi Local variety (1.89cm). If we discuss about the width of garlic clove cm we found similar trends of previous characters. The maximum garlic clove cm was recorded with Yamuna Safed-3 (G-282) 1.04cm followed by Yamuna Safed-1 (G-1) 1.03cm and the minimum remained with Madrasi Local variety (0.85cm) followed by NHRDF - 1, Deoria (0.86cm). These results are in agreement with findings of Metwally *et al.* (2003) [12]; Aslam *et al.* (2016) [2]; Patil *et al.* (2003) [14] who evaluated the performance of garlic genotypes for number of cloves per bulb, length of garlic clove and width of garlic clove. Significant differences were recorded among the genotypes with respect to weight of individual cloves of garlic. The maximum weight of individual cloves of garlic was recorded with Yamuna Safed-3 (G-282) 1.82g followed by Yamuna Safed-1 (G-1) 1.81g and the minimum remained with Madrasi Local variety (1.03g) followed by NHRDF - 1, Deoria (1.05g). The most important thing in this experiment of garlic was the yield. Yield is always affects the result of any experiment in any crop. On the marginal effect of garlic bulb yield per hectare was recorded with Yamuna Safed-3 (G-282) 101.87q followed by Yamuna Safed-1 (G-1) 99.56q was found maximum and the minimum remained with Madrasi Local variety (39.53q) during experimentation. The results are also in consonance with the finding of Kumar *et al.* (2017) [8] and Saraf *et al.* (2000) [15] who showed that all of the morphological characters in garlic genotypes were different from each other and differ significantly for bulb yield. In view of the experimental results obtained during the present investigation, variety Yamuna Safed-3 (G-282)

emerged as superior over all other varieties studied followed by Yamuna Safed-1 (G-1) in relation to germination, growth,

yield and quality of Garlic under the agro-climatic conditions of Allahabad.

**Table 1:** Mean performance of 18 garlic genotypes for growth characters under Allahabad agro-climatic conditions.

Genotypes	Germination percentage	Days taken for germination	Plant Hight (cm) 20 DAS	Plant Hight (cm) 120 DAS	Incidence of insect, pests and diseases percentage
Yamuna Safed - 1 (G-1)	100.00	7.00	16.50	60.15	30.25
Yamuna Safed - 3 (G-282)	100.00	6.00	16.53	62.40	30.20
Yamuna Safed - 2 (G-50)	100.00	7.00	16.27	59.70	30.27
Sweta (Selection - 10)	92.00	9.00	15.00	58.25	36.57
Godawari (Selection - 2)	91.00	9.00	14.70	57.52	37.12
Yamuna Safed - 4 (G-323)	100.00	8.00	16.00	59.20	32.40
Local Collection, Newada, Kaushambi	97.00	8.00	15.23	58.35	34.25
Local Collection, Soraon, Allahabad	93.00	9.00	15.13	58.30	35.08
Local Collection, Fatehpur Mandi	87.00	10.00	14.52	57.27	39.00
Local Collection, Pratapgarh	90.00	9.00	14.66	57.36	38.55
Local Collection, Varanasi	87.00	10.00	14.30	57.23	39.00
Local Collection, Adalpura, Varanasi	85.00	10.00	14.00	56.37	40.00
Local Collection, Koraon, Allahabad	85.00	10.00	14.10	57.20	39.50
Local Collection, Kaushambi	80.00	11.00	13.60	56.10	40.30
Local Collection, Gyanpur, SRD Nagar	72.00	11.00	13.50	56.08	40.35
NHRDF - 1, Deoria	70.00	12.00	13.20	56.00	40.60
Madras Local	69.00	12.00	13.13	54.77	41.50
Tabiti Local	100.00	8.00	15.30	58.46	33.52
S. Ed. ( $\pm$ )	0.38	0.08	0.08	0.19	0.49
C. D. (P = 0.05)	0.77	0.16	0.17	0.39	1.01

**Table 2:** Mean performance of 18 garlic genotypes for yield characters under Allahabad agro-climatic conditions.

Genotypes	Fresh weight of bulb (g)	Number of cloves per bulb	Length of individual cloves (cm)	Width of individual cloves (cm)	Weight of individual cloves (g)	Bulb yield (q ha <sup>-1</sup> )
Yamuna Safed - 1 (G-1)	38.29	21.11	2.90	1.03	1.81	99.56
Yamuna Safed - 3 (G-282)	39.18	21.48	2.93	1.04	1.82	101.87
Yamuna Safed - 2 (G-50)	36.17	20.25	2.85	1.02	1.79	94.04
Sweta (Selection - 10)	21.62	16.34	2.35	0.95	1.32	56.22
Godawari (Selection - 2)	20.44	16.26	2.30	0.94	1.26	53.14
Yamuna Safed - 4 (G-323)	33.40	18.90	2.59	1.01	1.77	86.84
Local Collection, Newada, Kaushambi	25.04	16.56	2.45	0.97	1.51	65.10
Local Collection, Soraon, Allahabad	24.01	16.50	2.36	0.96	1.46	62.42
Local Collection, Fatehpur Mandi	19.51	15.89	2.12	0.92	1.23	50.74
Local Collection, Pratapgarh	20.21	16.20	2.23	0.93	1.25	52.54
Local Collection, Varanasi	18.75	15.62	2.06	0.91	1.20	48.75
Local Collection, Adalpura, Varanasi	17.63	15.54	2.00	0.89	1.13	45.83
Local Collection, Koraon, Allahabad	18.45	15.62	2.05	0.90	1.18	47.96
Local Collection, Kaushambi	17.46	15.53	1.97	0.88	1.12	45.39
Local Collection, Gyanpur, SRD Nagar	16.82	15.48	1.96	0.87	1.09	43.74
NHRDF - 1, Deoria	15.77	15.03	1.95	0.86	1.05	40.99
Madras Local	15.20	14.76	1.89	0.85	1.03	39.53
Tabiti Local	30.41	17.40	2.50	1.00	1.75	79.08
S. Ed. ( $\pm$ )	0.33	0.06	0.01	0.003	0.02	0.85
C. D. (P = 0.05)	0.66	0.11	0.02	0.006	0.04	1.72

## References

1. Anonymous. Indian Horticulture Database National Horticulture Board, Gurgaon, Haryana, India. 2014, 6.
2. Aslam T, Dudi BS, Pandav AK, Rana MK. Evaluation of garlic (*Allium sativum* L.) genotypes for yield and yield attributing traits under semi arid zone of Haryana (Hisar). 2016; 11(1):96-100.
3. Bhatt Bhawana, Anil Kumar Soni, Kuldeep Jangid, Santosh Kumar. A Study on Genetic Variability, Character Association and Path Coefficient Analysis in Promising Indigenous Genotypes of Garlic (*Allium sativum* L.). Int. J. Pure App. Biosci. 2017; 5(1):679-686.
4. Futane NW, Jogdande ND, Gonge VS, Warade AD, Khandagal SS. Evaluation of garlic genotypes. Internat. J. Agric. Sci. 2006; 2(1):2-5.
5. Gupta RP. Annual Report 2012-13, National Horticultural Research and Development Foundation, Nashik (Maharashtra), 2014.
6. Harris JC, Cottrell SL, Plummer S, Lloyd D. Antimicrobial properties of *Allium sativum* L. (garlic). Application Microbiol. & Biotechnol. 2001; 57:282-286.
7. Khar A, Devi Asha, Mahajan V, Lawande KE. Performance studies of some promising garlic accessions under Rajgurunagar conditions. J. of Maharashtra Agricultural Universities. 2004; 29(2):214-216.
8. Kumar Sunil, Pande VP, Kumar Ashok. Genetic Variability, Heritability and Genetic Advance in Garlic (*Allium sativum* L.). Int. J. Pure App. Biosci. 2017; 5(3):849-853.
9. Lawande KE, Khar A, Mahajan V, Srinivas PS, Sankar V, Singh RP. Onion and garlic research in India. J. Hort. Sci. 2009; 4(2):91-119.
10. Mehra Rakesh, Batra Vinod. Evaluation of garlic varieties against purple blotch disease and yield. J. of Medicinal and Aromatic plant Sci. 2005; 27(1):7-9.
11. Memane PG, Tomar RS, Kakade DK, Kulkarni GU, Chovatia RS. Effect of clove weight and plant growth regulators on growth and yield of garlic (*Allium sativum* L.) cv. GG 3. Asian J. Hort. 2008; 3(1):82-86.
12. Metwally EI, El-Dewary ME, Tijksens LMM, Vallebreght HM. Evaluation of AVRDC International Garlic Collection under Egyptian conditions. Acta Horticulturae. 2003; 604:559-564.
13. Natale PJ, Camargo A, Gálmarjní CR. Characterization of argentine garlic cultivars by their pungency. Acta Hort. 2005; 688:313-316.
14. Patil BT, Ranpise SA, Birade RM. Studies on performance of colour garlic selections under Nasik conditions of Maharashtra. Orissa Journal of Horticulture. 2003; 31(1):54-57.
15. Saraf RF, Kurmvanshi SM, Sharma RS, Parihar MS. Relative performance of garlic (*Allium sativum* L.) varieties in Vindhyan Plateau of Madhya Pradesh. Crop Research, Hissar. 2000; 19(1):149-151.
16. Singh DK, Gupta RP, Choudhary SN. Studies on the evaluation of the performance of advance lines in garlic. News Letter National Horticultural Research and Development foundation. 2002; 22(2):11-15.
17. Singh Y, Chand R. Performance studies of some garlic (*Allium sativum* L.) clones. Himachal J. Agric. Res. 2003; 29(1-2):35-42.
18. Suberi H, Price TV. Stemphylium leaf blight of garlic (*Allium sativum* L.) in Australia. Australasian Plant Pathology. 2000; 29(3):192-199.
19. Tiwari RS, Ankur Agrawal, Sengar SC, Agrawal. A. Performance of garlic genotypes under Tarai Region of Uttaranchal. Progress. Hort. 2002; 34(2):183-186.
20. Vatsyayan S, Brar PS, Dhall RK, Singh H. Correlation and path analysis in garlic (*Allium sativum* L.).Vegetable Science. 2014; 41(1):54-55.