Assessment of Onion Varieties for Yield, Economics and Location suitabilityin Anantapur District, Andhra Pradesh

ABSTRACT

In order to identify suitable onion varieties for Ananthapur district of Andhra Pradesh, an On Farm Testing (OFT) was conducted during the *Rabi* seasons of 2022-23 and 2023-24 at Krishi Vigyan Kendra operated mandals of Ananthapur.Two high yielding onion varieties were tested with five locations during each year in comparisonto that of farmers variety of being grown by the farmers of the area. Different treatments included onionvariety NHRDF Red 4 (TO_1), NHRDF Red 3 (TO_2) and Bellary local variety as farmers practice. The resultsrevealed that highest plant height (58.25 cm), maximum number of leaves (8.35), lesser duration (123 days), maximum weight of bulb (77.76 g) and bulb yield (26.45 t/ha) was reported from NHRDF Red 4 than NHRDF Red-3 and farmers local variety (Bellary local). Similarly, NHRDF Red 4 variety recorded higher gross returns (Rs. 2,49,066/ha), net returns (Rs. 1,11,407/ha) and B:C ratio of 1.81 as compared to other two varieties.From the study, it is concluded that onion variety NHRDF Red-4 had better performance in the trial and can be recommended for cultivation in Ananthapur district of Andhra Pradesh.

Key words:*Onion, Genotypes, Farmer practice, Yield, Economics*

1. INTRODUCTION

Onion (*Allium cepa* L.) is widely regarded as an important vegetable crop, valued not just for its culinary applications but also for its numerous health benefits [1]. This crop holds significant importance in India's commercial agricultural sector. Globally, there is a growing demand for onions. As a vegetable and spice, it can be utilized when the bulb is raw or fully grown [2]. According to FAO, 93,226,400 tons of onions are produced globally each year, with China leading the production with 24,040,509 tons, followed by India with 21,415,425 tons [3]. Though, India comes in second place in terms of production and first in terms of area after China; nevertheless, its productivity is far lower than that of the top producers, which include the USA, the Netherlands, and China [4]. India is the second world's largest producer, covering 1.62 million ha and yielding 26.64 million tons in 2020–21, with a productivity of 16.4 t/ha [5].The major onion producing states in the country are Maharashtra, Madhya Pradesh, Karnataka, Rajasthan, Bihar, Gujarat, Andhra Pradesh, Haryana, West Bengal and Uttar Pradesh in the country. These States account for almost 90% of the total onion production in the country [6]. However these production statistics can vary from year to year due to factors like weather conditions, crop pest and diseases and market demand. Andhra Pradesh is producing about 2% of onions with a production of 636.5 thousand tons from an area of 40880 ha with a productivity of 15.57 t/ha, which is comparatively less than the average productivity of the country [5].Productivity can be increased by utilizing high yielding varieties along with implementing modern agro-techniques developed by various research institutes. Onion output is mostly determined by the adoption of high-yielding varieties and a variety's suitability to a certain agro climatic location.Bellary local is the dominant variety that is well acclimatized and grows in the KVK operational area; however it has a longer duration than other genotypes. In addition to this variety, several cultivars are grown in large extent, but scientific data on their effectiveness in terms of crop duration, bulb size and bulb yield is lacking.In this respect, the current study on the assessment of various onion varieties on yield and economics in Anantapur district, Andhra Pradesh was carried out during the *rabi* season of 2022-23 and 2023-24 in Andhra Pradesh's scanty rainfall zone.

2. MATERIALS AND METHODS

The study was carried out by Krishi Vigyan Kendra, Kalyandurg during the *Rabi* season of 2022-23 and 2023-24 to assess the performance of onion varieties in Ananthapur district of Andhra Pradesh under scientific management practices. Two high yielding onion varieties were tested with 5 locations during each year. The treatments include three onion varieties NDHRF Red 4 (TO_1), NDHRF Red 3 (TO_2) and Bellary local as farmers practice and the varietal characteristics of each variety tested are

depreciated in table 1. Seeds are sown directly on the raised beds of 1m width and convenient length at spacing of 15 x 10 cm during the middle of October. The first light irrigation was given just after sowing and thereafter as and when needed depending upon moisture availability in the soil and was withheld before 10 days of harvest. Recommended agronomic practices were followed to raise the crops successfully as suggested by Dr YSR Horticultural University. The observations recorded included plant height, number of leaves per plant, weight of bulb, days to maturity and bulb yield. The bulbs were harvested by hand pulling. Data on plant height (cm) and number of leaves per plant were determined from 10 randomly selected representative plants at 90 DAS from the middle rows of each variety under evaluation and then average values per plant was worked out (Table 2). Plant height was measured from the base of the plant to tip of the plant using meter tape. Days to physiological maturity was determined by counting the actual number of days from date of sowing until 90% of the leaves of the plant senesced.The average bulb weight (g) was determined using 10 randomly selected representative plant bulbs from middle rows of each tested variety and weighed using electronic balance and then the average values per bulb were worked out. Data on bulb yield (t/ha) was determined after harvest of the marketable bulb from the field and expressed in t/ha. Economics of onion was worked out based on the current market price of inputs and outputs as suggested by Nagarjuna *et al*[7].

3. RESULTS AND DISCUSSION

The performance of onion varieties on growth parameters and days to maturity were recorded and presented in the Table 2. The pooled outcome results revealed that highest plant height (58.25 cm) was reported from onion variety NHRDF Red 4 (Table 2) followed by NHRDF Red 3 (55.55 cm) and the lowest by farmers practice of using Bellary local variety (49.3 cm). Similarly, onion variety NHRDF Red 4 registered maximum number of leaves (8.35) followed by NHRDF Red 3 (7.55) and the lowest by Bellary local (5.75). The variation in the plant height of different onion genotypes might be due to thechanges in genetic inheritance of the individualgenotypes.Bindu and Bindu [8] and Jana *et al.*[9] also reported an increase in height and an increase in leaf number among the various onion genotypes as a result of genetic inheritance.Data on days to maturity is presented in the table 2 revealed that the days required for bulb maturity was relatively more during first year of study than second year.From the pooled data, NHRDF Red 4 required shortest duration for bulb maturity (123 days)than compared to NHRDF Red 3 (128 days) and farmers practice of using Bellary local (134 days).This reveals that NHRDF Red 4 onion variety matured 5 and 9 days earlier than NHRDF Red 3 and Bellary local, respectively (Table 2). The difference in maturity could be attributed to differences in onion varieties. The variation in maturity across onion varieties may be attributable to genetic characteristics and how the varieties react in the environment. This conclusion is consistent with the findings of Kahsay*et al* [10] and Kitila*et al* [11], who observed differences in maturity times due to the usage of different genotypes.

The average bulb weight is a bulb yield component of onion and it was notably impacted by onion varieties tested (Table 2). The pooled outcome results on average bulb weight revealed that maximum bulb weight (77.76g) was reported from onion variety NHRDF Red 4 followed by NHRDF Red 3 (71.06g) and the minimum by farmers practice of using Bellary local variety (65.24g). The difference between highest and lowest average bulb weight was about 12.52g. This shows that NHRDF Red 4 variety had produced 9.4% additional average bulb weight as compared to variety NHRDF Red 3 and 19.2% as compared to farmers variety. As NHRDF Red 4 variety had produced additional average bulb weight had confirmed superiority of NHRDF Red 4 variety over other two varieties tested. This resultis in agreement with the findings of Tripathy *et al.*[12], Behera *et al.*[13] and Begna *et al*[14], who reported that different varieties may have different average bulb weight. The differences in the bulb yield (t/ha) of different onion varieties tested are presented in the Table 2. The pooled outcome results on bulb yield revealed that highest bulb yield (26.45 t/ha) was reported from onion variety NHRDF Red 4 followed by NHRDF Red 3 (24.2 t/ha) and the lowest by farmers practice of using Bellary local variety (21.68 t/ha).This shows that NHRDF Red 4 variety had produced 21.9% additional bulb yield and NHRDF Red 3 had produced 11.7% additional bulb yield as compared to farmers' variety of Bellary local. The variation in bulb yield could be attributed to changes in the genotype of the three onion varieties tested. Furthermore, because average bulb weight has a direct effect on onion bulb production, the variety with the highest average bulb weight indicates strong yielding potential and superior performance. The variation in the bulb yield differed between the genotypes was also reported byHirave*et al* [15], Bal*et al.*[16] and Begna *et al* [14].

Economic indicators *i.e.* Cost of cultivation, gross returns, net returns and Benefit Cost ratio (B:C) ratio of tested varieties are presented in Table 3. The cost of cultivation was higher in farmers practice over the tested varieties during both the years and on pooled data. Farmers cultivating NHRDF Red 4 and NHRDF Red 3 could save Rs. 7843/- and Rs. 6452/- over the farmers practice, respectively (Pooled data). Year-to-year variability in cultivation costs can be explained by differences in the local social and economic conditions. The higher cost of production in farmers practice might be due to higher seed cost and indiscriminate use of chemicals for control of purple blotch. NHRDF Red 4 variety recorded higher gross returns (Rs. 2,49,066/ha), net returns (Rs. 1,11,407/ha) and B:C ratio of 1.81 as compared to other two varieties. Furthermore, cultivation of the NHRDF Red 4 variety resulted in additional net returns of Rs. 27,793 and Rs. 57,341 over NHRDF Red 3 and Bellary local, respectively indicating that it is more profitable and economically viable.Similar observation of increased economic benefit by growing NHRDF Red 4 over NHRDF Red 3 and local varieties were also reported by Tiwari*et al*[17] and Sable *et al*[18].

4. CONCLUSION

OFT was conducted during 2022-23 and 2023-24*Rabi*season at KVK operated mandals of Ananthapur district using twoimproved onion varieties (NHRDF Red 4 &NHRDF Red 3) under irrigation conditions. At the study area, farmershave been producing onion crop for consumption and marketpurposes, however, its productivity andproduction is very low due to lack of improved onion varieties. Hence, the productivity andproduction of onion could be maximized using improved onionvarieties suitable for the study area. Based on results of different varieties tested forcultivation in *Rabi* season revealed that the variety NHRDF Red 4 can be adopted for cultivation in Ananthapur district of Andhra Pradesh because of its higher yield, location suitability and economic viability.

REFERENCES

1. Ochar K, Kim SH. Conservation and Global Distribution of Onion (Allium cepa L.) Germplasm for Agricultural Sustainability. Plants. 2023; 12(18):3294.
2. Mohanty BK, Prusti AM. Performance of common onion varieties in kharif seasons. Journal of Tropical Agriculture. 2001; 39(1):21-3.
3. FAO STAT. Food and Agriculture Organisation of the United Nations Statistical Database; Statistical Division; FAO: Rome, Italy, 2021; Available online: **http://www.fao.org/statistics/en/** (accessed on 12 January2024).
4. Choudhary DR, Gora JS. Onion: Production Constraints and Their Management Popular Kheti. 2015; 3 (3): 40-47.
5. Agricultural Statistics at a Glance. Directorate of Economics and Statistics. 2022. Accessed on 06 December 2023. Available:https://desagri.gov.in/wp-content/uploads/2023/05/Agricultural-Statistics-at-a-Glance-2022.pdf
6. Indian Horticulture database. National Horticulture Board, Ministry of Agriculture, GOI 2020. Accessed on 18 December 2023. Available: https://www.nhb.gov.in/statistics/Reports/Onion-for-October-2020.pdf
7. Nagarjuna D, Mallikarjun M, Jyothi GL, Sumathi V. Impact of Cluster Frontline Demonstration on Productivity and Profitability of Blackgram. Journal of Krishi Vigyan. 2022;11(1):206-10.
8. Bindu B, Bindu P. Performance evaluation of onion (Allium Cepa L. Var. Cepa) varieties for their suitability in kollam district. International Journal of Research Studies in Agricultural Sciences. 2015; 1(1): 18-20.
9. Jana K, Thapa U, Kundu S, Hansda NN, Ray K, Tamang D. Evaluation of Different Genotypes of Late Kharif Onion (Allium cepa L.) Under the Gangetic Plains of West Bengal, India. International Journal of Plant & Soil Science. 2023 Nov 22;35(22):295-305.
10. Kahsay Y, Belew D, Abay F. Effect of intra-row spacing on yield and quality of some onion varieties (Allium cepa L.) at Aksum, Northern Ethiopia. African Journal of plant science. 2013 Dec 31;7(12):613-22.
11. Kitila C, Abraham A, Shuma S. Growth and bulb yield of some onion (Allium cepa L.) varieties as influenced by NPS fertilizer at Dambi Dollo University Research site, Western Ethiopia. Cogent Food & Agriculture. 2022;8(1):1-11.

12. Tripathy P, Sahoo BB, Priyadarshini A, Das SK, Dash DK. Standardization of kharif onion cultivars. International Journal of Bio-resource and Stress Management. 2014;5(2):269-74.
13. Behera TK, Mandal J, Mohanta S, Padhiary AK, Behera S, Behera D, Rout RK. Assessment of growth, yield and quality of onion genotypes under red and laterite zone of West Bengal. Journal of Pharmacognosy and Phytochemistry. 2017;6(6):493-7.
14. Begna T, Sirba HY, Gojam M (2022) Evaluating the Performance of Recently Released Onion (Allium Cepa L.)Varieties at Highland Areas of West Hararghe, Ethiopia. Adv Crop Sci Tech. 2022;10 (12): 544.
15. Hirave PS, Wagh AP, Alekar AN, Kharde RP. Performance of red onion varieties in kharif season under Akola conditions. Journal of Horticulture. 2015;2(2):1-3.
16. Bal S, Maity TK, Maji A. Evaluation of onion genotypes for growth, yield and quality traits under gangetic alluvial plains of West Bengal. Int. J. Chem. Stud. 2020;8:2157-62.
17. Tiwari JK, Kumar A, Singh S. Evaluation of different rabi onion varieties under Bihar conditions: Performance of rabi onion varieties. Journal of Agri Search. 2022;9(3):222-5.
18. Sable PA, Saras PK, Patel JR. Assessment of rabi onion varieties for the region of North Gujarat. The Pharma Innovation Journal 2023; 12(5): 3829-3833

Table 1: Characters of different onion varieties tested.

NHRDF-Red-4	Bulbs are dark red in colour, globular round in shape with thin neck and 5.5-6.25 cm in diameter. Crop matures in 110-120 days after transplanting. Keeping quality of bulbs is good. They contain 12-140B total soluble solids, 13-14% dry matter and 13.0 micro mole/g pyruvic acid. The variety gives an average yield of 350-400 q/ha.The variety is moderately tolerant to foliar diseases like stemphylium blight and purple blotch under field condition.
NHRDF-Red-3	Bulbs are light bronze in colour, globular round in shape with thin neck and 5.5-6.0 cm in diameter. Crop matures in 120-130 days after transplanting. Keeping quality of bulbs is good. They contain 12-130B total soluble solids, 13-14% dry matter and 12.50 micro mole/g pyruvic acid. The variety gives an average yield of 350-400 q/ha.
Bellary Local	Bulbs are light red in colour, globular round in shape with thin neck and 5.0-6.0 cm in diameter. Crop matures in 130-140 days after transplanting. Keeping quality of bulbs are good. This variety gives an average yield of 300-350 q/ha.

Table 2: Biometric characters, yield attributes and yield of tested onion varieties.

Parameter	2022-23			2023-24			Pooled		
	NHRDF Red 4	NHRDF Red 3	Bellary Local	NHRDF Red 4	NHRDF Red 3	Bellary Local	NHRDF Red 4	NHRDF Red 3	Bellary Local
Plant Height (cm) at 90 DAS	57.3	56.7	50.1	59.2	54.4	48.5	58.25	55.55	49.3
Leaf Number/plant at 90 DAS	8.6	7.9	6.4	8.1	7.2	5.1	8.35	7.55	5.75
Average bulb Weight (g)	78.24	72.52	65.68	77.28	69.6	64.8	77.76	71.06	65.24
Days to maturity	126	133	140	120	123	127	123	128	133.5
Bulb Yield (t/ha)	27.54	24.32	22.24	25.36	24.08	21.12	26.45	24.2	21.68
% increase in Yield	23.8	9.4		20.0	14.0		21.9	11.7	

Table 3: Economics of onion production of tested onion varieties.

Economic Parameter	2022-23			2023-24			Pooled		
	NHRDF Red 4	NHRDF Red 3	Bellary Local	NHRDF Red 4	NHRDF Red 3	Bellary Local	NHRDF Red 4	NHRDF Red 3	Bellary Local
Cost of cultivation (Rs/ha)	152568	153100	155754	122750	125000	135250	137659	139050	145502
Gross Returns (Rs/ha)	269892	228608	209056	228240	216720	190080	249066	222664	199568
Net Returns (Rs/ha)	117324	75508	53302	105490	91720	54830	111407	83614	54066
B:C Ratio	1.77	1.49	1.34	1.86	1.73	1.41	1.81	1.60	1.37