



Assessment of chickpea varieties NBeG-776 and NBeG-452 in SPSR Nellore district of Andhra Pradesh

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Abstract

The present investigation was carried out to assess the field performance of improved chickpea (*Cicer arietinum* L.) varieties NBeG-776 and NBeG-452 in comparison with the widely cultivated variety JG-11 under rainfed vertisol conditions of SPSR Nellore district, Andhra Pradesh, during the rabi seasons of 2023-24 and 2024-25. The study was conducted through On-Farm Trials (OFTs) at six farmer fields across three mandals, utilizing a participatory research approach to assess varietal response. Significant differences were observed among the varieties regarding yield and yield attributes. NBeG-776 recorded the highest mean plant height (45.3 cm), number of pods per plant (31.3), and 100-seed weight (25.4 g), resulting in a highest seed yield of 1721 kg/ha. In terms of economic returns, NBeG-776 achieved the highest gross returns (₹1,00,235/ha), net returns (₹43,239/ha) and benefit-cost ratio (1.79). This variety also exhibited desirable plant architecture traits such as an erect growth habit and height of first pod (31.0 cm), rendering it highly suitable to mechanical harvesting. The trials were conducted under varying climatic conditions, with unpredictable rainfall patterns, particularly after sowing and during the reproductive phase, affecting crop establishment and yield. The varietal performance under such fluctuating weather conditions highlights the adaptability and resilience of NBeG-776. These findings indicate that NBeG-776 is a promising cultivar for enhancing productivity and profitability in rainfed cultivation and represents a suitable replacement for JG-11 in the region. The study underscores the relevance of varietal substitution and machine harvestable variety in strengthening pulse production systems under changing agro-economic conditions.

Keywords: Chickpea, mechanical harvesting, NBeG-776, on-farm trials, rainfed cultivation

Introduction

India holds the distinction of being the world's largest producer, consumer, and importer of pulses, accounting for approximately 33% of the global area under pulse cultivation and 22% of total production (Rajiv Kumar, 2020) [5]. Among the various pulse crops, chickpea (*Cicer arietinum* L.) stands out as one of the most important and widely cultivated in the country. India leads the world in both production and consumption of chickpea, with cultivation spread over about 10 million hectares, producing 11.9 million tonnes at a productivity level of approximately 1192 kg ha⁻¹ during 2021-22 (Deva *et al.*, 2019; Anonymous, 2022) [1, 8]. Chickpea is a cool-season legume belonging to the family Fabaceae and is predominantly cultivated in semi-arid regions due to its adaptability to limited soil moisture conditions. Being a deep-rooted and drought-tolerant crop with high water use efficiency, chickpea is particularly suitable for rainfed ecosystems. It is broadly classified into two types - Desi (small-seeded, angular, and pigmented) and Kabuli (large-seeded, beige-colored) - with Desi types predominating in India. Nutritionally, chickpea is rich in proteins (18-22%), carbohydrates (50-60%), and essential minerals such as iron and calcium, along with dietary fiber, making it a key component of vegetarian diets. Additionally, chickpea crop residues, including dried stems, leaves, and pod husks, serve as valuable fodder for livestock. In Andhra Pradesh, chickpea is cultivated over an area of 4.59 lakh hectares, producing 5.59 lakh tonnes with an average productivity of 1218 kg/ha (Siva Jyothi and Lahari, 2022) [9]. Within SPSR Nellore district, it ranks as the second most important pulse crop after blackgram, covering an area of 11,833 hectares with an average yield of 1418 kg/ha. The chickpea variety JG-11 has long been the predominant cultivar grown in this

district. However, its continuous cultivation has led to a gradual decline in productivity, primarily due to reduced resistance to evolving biotic stresses such as pests and diseases. This scenario underscores the need to introduce and disseminate newly released, location-specific chickpea varieties with superior yield potential and enhanced resistance to biotic stresses. Furthermore, the semi-spreading growth habit and low pod-setting height of JG-11 make it unsuitable for mechanical harvesting, thereby increasing labor dependence and production costs. In contrast, promising new varieties such as NBeG-776 and NBeG-452 have shown better adaptability, exhibiting erect growth habit, higher pod-setting, and desirable morphological traits that make them more suitable for mechanical harvesting, along with higher yield potential and improved resistance to diseases and pests (Jayalakshmi *et al.*, 2025) [4]. To address these challenges and assess the performance of these improved chickpea varieties under real-farm conditions, an On-Farm Trial (OFT) was planned and conducted in farmer's fields. OFTs are a key extension tool used to evaluate and demonstrate new agricultural technologies under practical farming conditions. As part of the core mandate of Krishi Vigyan Kendras (KVKs), these trials aim to bridge the gap between research institutions and the farming community. By testing innovations within specific agro-climatic contexts, OFTs enhance the relevance and adaptability of technologies, ultimately promoting wider adoption by farmers. This study is significant because it evaluates the field performance of newly released chickpea varieties NBeG-776 and NBeG-452 in comparison to the existing popular variety JG-11 under the agro-ecological conditions of SPSR Nellore district. The results will provide location-specific recommendations for varietal replacement, thereby contributing to sustainable chickpea intensification,

reduced production costs, and improved farm profitability. The main objective of this study is to evaluate the yield performance, resistance to biotic stresses, and suitability for mechanical harvesting of chickpea varieties NBeG-776 and NBeG-452 through On-Farm Trials, in comparison with the existing variety JG-11 under the rainfed conditions of SPSR Nellore district.

Materials and Methods

On-Farm Trials (OFTs) were conducted during the rabi seasons of 2023-24 and 2024-25 by Krishi Vigyan Kendra, Nellore, SPSR Nellore district to evaluate the performance of improved chickpea (*Cicer arietinum* L.) varieties NBeG-776 and NBeG-452 in comparison with the widely cultivated variety JG-11 under rainfed vertisol conditions. The OFT was conducted over an area of 0.1 ha across six (06) farmer’s field situated in three mandals of SPSR Nellore district viz., Chavatapalli (Kaluvoya), Kothuru and Anantapuramu (Kaligiri), and Hasanapuram (Anumasamudrampeta). Seeds of the improved chickpea varieties NBeG-776 and NBeG-452 were procured from the Regional Agricultural Research Station (RARS), Nandyal, Acharya N.G. Ranga Agricultural University and distributed to the participating farmers. The varietal characteristics of NBeG-776, NBeG-452 and the check variety JG-11 are summarized in Table 1. The experimental soil was classified as vertisols, characterized by low available nitrogen and medium levels of phosphorus and potassium. Rainfall data for the cropping seasons 2023-24 and 2024-25 are presented in Table 2. Field preparation consisted of one ploughing followed by three passes with a cultivator to achieve a fine

tilth suitable for sowing. Chickpea varieties were sown using a seed-cum-fertilizer drill at a uniform seed rate of 125 kg/ha to ensure optimum depth and spacing. Sowing was carried out at second fortnight of November to the first fortnight of December. All the seeds were treated with *Trichoderma viride* @ 10 g/kg seed to control seed and soil-borne pathogens. A pre-emergence application of pendimethalin 30% EC at 2.5 litres/ha was done one day after sowing (1 DAS) for effective weed management. Fertilizers were applied as per the recommended nutrient for chickpea. For insect pest management, an appropriate insecticide was sprayed at 20 DAS, followed by manual weeding at 25 DAS. A tank mix of fungicide and insecticide was applied at 40 DAS to control foliar diseases and insect pests. Additionally, a second round of insect-pest management and foliar application of micronutrients was carried out at 60 days after sowing (DAS) to promote healthy crop growth and to enhance pod development. Harvesting was performed manually at physiological maturity, followed by threshing, bagging and transportation. Frequent field visits were conducted by KVK scientists at critical crop growth stages to monitor the crop performance, provide advisory services and ensure proper implementation of recommended practices. Seed yield was recorded from a net plot area of 25 m² (5 × 5 m). Additionally, biometric observations were recorded from ten randomly selected plants to assess growth parameters and yield attributes, including plant height (cm), number of branches per plant, number of pods per plant, 100-seed weight (g) and the height of the first pod from the base of the plant (cm).

Table 1: Salient features of NBeG-776, NBeG-452 and JG-11

S. No	Variety	Year of release	Duration (days)	Yield (q ha ⁻¹)	100 seed weight (g)	Characteristics
1	NBeG-776	2022	95-105	17.5-20 (Rainfed) 25-30 (one or two irrigations)	22.0-24.0	Resistant to wilt, Amenable to machine harvesting, It is recommended as a better alternative to JG-11 and other desi varieties.
2	NBeG-452	2020	90-105	17.5-22.5 (Rainfed) 25-30 (one or two irrigations)	22.0-24.0	Resistant to wilt, It is a better alternative to JG-11 and other popular desi varieties grown by farmers in Andhra Pradesh.
3	JG 11	1999	90-95	17.5-20 (Rainfed) 25-30 (one or two irrigations)	25.0	Resistant to fusarium wilt.

Table 2: Rainfall particulars of SPSR Nellore district in 2023-24 and 2024-25

Month	Normal Rainfall	2023-24		2024-25	
		Actual	Deviation	Actual	Deviation
June	51.9	19.2	-63	71.1	37
July	81.5	81.5	0	125.9	54
August	83.5	34.1	-59	44.4	-47
September	103.5	83.3	-20	74.9	-28
October	249.1	20.6	-92	347.9	40
November	297.7	258.1	-13	193.2	-35.1
December	99.1	297.4	200	202.6	104.4
January	12.5	0.3	-97	2.9	40
February	5.4	0.0	-100	0.0	-35.1
Total	993.8	794.4	-19	1066.5	7.3

Table 3: Growth parameters and yield attributes of improved varieties NBeG-776, NBeG-452 and check variety JG-11

Particulars	Plant height (cm)			No. of branches/plant			No. of pods/plant			100 seed weight (g)			Height of first pod from the base of plant (cm)		
	2023-24	2024-25	Average	2023-24	2024-25	Average	2023-24	2024-25	Average	2023-24	2024-25	Average	2023-24	2024-25	Average
T1: NBeG-776	45.8	44.8	45.3	11.3	10.8	11.05	32.3	30.3	31.3	25.8	25.0	25.4	31.7	30.3	31.0

T2: NBeG-452	36.7	35.7	36.2	10.3	10.1	10.2	29.3	27.3	28.3	24.4	24.4	24.4	24.0	23.5	23.8
T3: Farmer Practice (JG-11)	34.8	34.1	34.5	8.7	8.5	8.6	27.7	25.6	26.7	22.4	21.6	22.0	22.3	21.9	22.1

Table 4: Yield and economics of improved varieties NBeG-776, NBeG-452 and check variety JG-11

Particulars	Seed yield (kg/ha)			Cost of cultivation (₹/ha)			Gross returns (₹/ha)			Net returns (₹/ha)			B:C ratio		
	2023-24	2024-25	Average	2023-24	2024-25	Average	2023-24	2024-25	Average	2023-24	2024-25	Average	2023-24	2024-25	Average
T1: NBeG-776	1735	1706	1721	51068	62923	56996	104080	96389	100235	53012	33466	43239	2.04	1.53	1.79
T2: NBeG-452	1655	1651	1653	58082	62923	60503	99280	93300	96290	41228	30377	35803	1.71	1.48	1.60
T3: Farmer Practice (JG-11)	1562	1519	1541	54856	58673	56765	93700	85842	89771	38844	27169	33007	1.71	1.46	1.59

Results and Discussion

Rainfall Distribution

Chickpea crop was sown from the second fortnight of November to the first fortnight of December in both 2023-24 and 2024-25. The rainfall pattern during this critical sowing window had a significant impact on crop establishment. In 2023-24, November received 258.1 mm of rainfall, slightly below normal (-13%), which was generally adequate for field operations and sowing. However, December received abnormally high rainfall of 297.4 mm, registering a 200% positive deviation from the normal. In contrast, the 2024-25 season experienced a significant rainfall deficit in November, receiving only 193.2 mm (-35.1% deviation), followed by substantial rainfall in December with 202.6 mm (+104.4% deviation), indicating an uneven moisture distribution during the early crop growth period. This excessive post-sowing precipitation resulted in temporary waterlogging, which adversely affected germination, increased the incidence of seedling diseases and ultimately led to poor crop stand and reduced early vigour. Furthermore, rainfall during January and February is critical for chickpea growth, as these months coincide with the flowering and pod development stages. In both 2023-24 and 2024-25, rainfall during this period was extremely limited, with January receiving only 0.3 mm and 2.9 mm, respectively, and February recording no rainfall in either year. This persistent moisture deficit during the reproductive phase likely induced stress, adversely affected flowering, pod setting and ultimately reduced the crop's yield potential in both seasons.

Growth Parameters and Yield Attributes

The improved variety NBeG-776 recorded the highest average plant height (45.3 cm), number of branches/plant (11.05), number of pods/plant (31.3), 100 seed weight (25.4 g) and height of first pod from the base of plant (31.0 cm), indicating its superior growth and yield attributes under the rainfed vertisol conditions of SPSR Nellore district. The variety NBeG-452 showed moderate performance with an average plant height (36.2 cm), branches/plant 10.2, pods/plant (28.3), 100 seed weight (24.4 g) and height of first pod height from the base of the plant (23.8 cm). In contrast, the farmer's variety JG-11 recorded the lowest values for all parameters. These results indicate that the improved varieties, particularly NBeG-776, performed better than the traditional variety JG-11 in terms of growth and yield attributes. Chickpea harvesting in India is predominantly manual, primarily due to the morphological limitations of widely cultivated varieties. Most existing cultivars exhibit a semi-spreading growth habit, inadequate

plant height and height of the first pod is low (approximately 15-20 cm from the ground), making them unsuitable for mechanical harvesting. While certain operations such as sowing, pesticide spraying and weed management have been mechanized, harvesting remains only partially mechanized, typically involving manual cutting followed by mechanical threshing. Reliance on manual labour imposes several constraints on chickpea cultivation. Delays in harvesting, particularly during unfavourable weather conditions, often lead to considerable yield losses due to pod drop. Additionally, the rising cost and shrinking availability of farm labour significantly increase the overall cost of cultivation. In this context, the development and promotion of chickpea varieties suitable for full mechanization offer a promising solution. Such varieties would enable timely harvesting, reduce dependence on labour and mitigate yield losses due to adverse weather (Basha *et al.*, 2018) [2]. Tall chickpea cultivars exhibiting a 30-40% increase in plant height over existing varieties, along with a semi-erect to erect growth habit and primary branching initiated at 25-30 cm above ground level, are considered suitable for mechanical harvesting (Divya Madhuri & Jayalakshmi, 2019). These plant types facilitate higher planting density per unit area, thereby enhancing yield potential. Additionally, their architecture allows greater solar radiation penetration into the canopy, which reduces humidity build-up and mitigates the incidence of foliar diseases (Vishnu *et al.*, 2018) [10]. NBeG-776 is a chickpea variety developed and released in 2022 by Acharya N.G. Ranga Agricultural University, specifically bred for compatibility with mechanical harvesting. The variety exhibits an erect growth habit, increased plant height and pod-setting well above ground level, which collectively address the primary limitations of conventional cultivars such as low height of the first pod and spreading growth (Munirathnam *et al.*, 2015) [6]. These traits enable efficient machine harvesting, making NBeG-776 a suitable choice for mechanized and cost-effective chickpea production systems.

Yield and Economics

The average results of two years showed that the chickpea variety NBeG-776 recorded the highest seed yield of 1721 kg/ha, surpassing both NBeG-452 (1653 kg/ha) and the farmer's variety JG-11 (1541 kg/ha). This superior productivity translated into the highest gross returns of ₹1,00,235/ha and net returns of ₹43,239/ha, outperforming NBeG-452 and JG-11. Additionally, NBeG-776 achieved the highest Benefit-Cost (B:C) ratio of 1.79. The favorable cost-benefit ratio clearly demonstrated the economic

viability of the intervention and convinced the farmers to adopt the improved variety (Rai *et al.*, 2021)^[7].

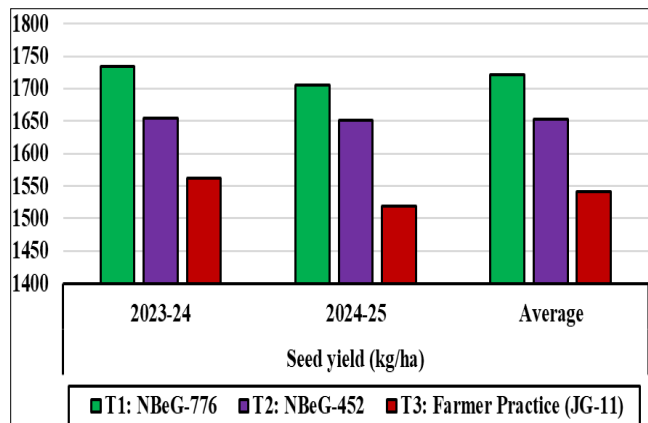


Fig 1: Performance of improved varieties NBeG-776, NBeG-452 and check variety JG-11

Conclusion

The findings of the On-Farm Trials conducted in the SPSR Nellore district demonstrate the superior performance of the chickpea variety NBeG-776 over NBeG-452 and the traditionally grown JG-11. NBeG-776 not only demonstrated superior growth and yield attributes but also ensured higher economic returns and suitability for mechanical harvesting, owing to its erect growth habit and high pod-setting, with the first pod positioned at 30.3 cm from the plant base. Adoption of this variety can significantly address the challenges associated with manual harvesting, rising labour costs and biotic stresses, thereby enhancing chickpea productivity and profitability in the region. Promotion of this variety through large-scale demonstrations and seed distribution can accelerate varietal replacement and contribute to sustainable pulse production in the region.

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Declaration of Interest

On behalf of all authors, the corresponding author states that there is no conflict of interest.

Data Sharing

All relevant data are included within the manuscript and are also available from the corresponding author upon reasonable request.

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