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On-Farm evaluation of chickpea variety Phule Vikrant (Phule G-0405) under irrigated conditions in Solapur District of Maharashtra

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Abstract

On-farm trials were conducted on farmers' field during the rabi season of 2020-2021, 2021-2022 and 2022-2023 to evaluate the performance of the improved chickpea (*Cicer arietinum* L.) variety Phule Vikrant (Phule G-0405) under irrigated conditions in Solapur district of Maharashtra. The trials aimed to assess growth, yield attributes, water use efficiency, and economic returns in comparison with the farmer-preferred local cultivar and practices. The results revealed that *Phule Vikrant* recorded superior growth parameters, higher grain yield, and better water productivity under irrigated conditions. The improved variety recorded significantly higher grain yield (22.17qha^{-1}) compared to the local check (17.35qha^{-1}), resulting in a yield advantage of 27.59%. Higher yield attributes, early maturity, and better economic returns contributed to its superior performance. The variety also resulted in higher net returns (63656 Rs./ha.) and benefit-cost ratio (2.26), indicating its suitability for irrigated chickpea cultivation in the semi-arid conditions of Solapur district.

Keywords: Chickpea, Phule Vikrant, on-farm trial, irrigated condition, Solapur district, yield, economics

Introduction

Chickpea (*Cicer arietinum* L.) is one of the most important cool-season grain legumes cultivated worldwide and is a major source of dietary protein, carbohydrates, minerals, and fiber for human consumption (FAO, 2022) [3]. It plays a crucial role in sustainable agriculture due to its ability to fix atmospheric nitrogen through symbiotic association with *Rhizobium*, thereby improving soil fertility and reducing the requirement for chemical nitrogen fertilizers (Peoples *et al.*, 2009) [13]. Chickpea is well adapted to semi-arid and arid regions because of its tolerance to drought and efficient utilization of residual soil moisture, making it suitable for both rainfed and irrigated production systems (Kumar *et al.*, 2021) [9]. In India, chickpea constitutes a major share of rabi pulse production and significantly contributes to nutritional security and farm income, particularly for small and marginal farmers (Government of India, 2023) [4]. Therefore, improvement in chickpea productivity through the adoption of high-yielding varieties and region-specific crop management practices is essential to meet the growing demand for pulses while sustaining soil health and agricultural productivity (Ali and Gupta, 2012) [11].

Chickpea (*Cicer arietinum* L.) is a major pulse crop of India and Maharashtra plays a vital role in ensuring nutritional security and soil health. Solapur district, located in the rain-shadow region of the Western Maharashtra plateau, is characterized by low and erratic rainfall, making chickpea cultivation highly vulnerable to moisture stress (Patil *et al.*, 2017) [12]. Although chickpea is traditionally grown under rainfed conditions in the district, the increasing availability of protective irrigation through dams, wells and farm ponds has encouraged farmers to adopt irrigated chickpea cultivation to stabilize yields.

India contributes more than 65 per cent of the global chickpea area and production, with Maharashtra being one of the leading states (FAO, 2022) [3]. Chickpea is a leading grain crop among the crops grown in the rabi season. In the year 2023-2024 the area, production and productivity of chickpea in Maharashtra was 26.61 Lakh ha, production 28.60 Lakh tones and productivity was 1072 kg ha^{-1} respectively. Maharashtra's share in the country's total chickpea

production is 26 per cent. However, productivity in Solapur district remains below the national and state average due to terminal drought, sub-optimal varieties, and inadequate crop management (Singh *et al.*, 2018) ^[14]. Improved varieties responsive to irrigation can significantly enhance yield and profitability in such semi-arid ecosystems.

The chickpea variety Phule Vikrant (Phule G-0405), developed by Mahatma Phule Krishi Vidyapeeth (MPKV), Rahuri, was released in the year 2017 for the Western Cotton Zone (Maharashtra, Gujarat, West Madhya Pradesh and South Rajasthan) owing to its medium duration, Yellowish brown medium size seeds, yield potential, and resistance to Fusarium wilt and suitable for irrigated condition. Previous studies have reported that improved chickpea varieties combined with irrigation at critical growth stages can substantially improve yield and water use efficiency (Kumar *et al.*, 2020) ^[8]. On-farm trials provide an effective platform to evaluate such technologies under real farming conditions and to assess their suitability for local adoption (Meena *et al.*, 2019) ^[10]. However, systematic evaluation of its performance under farmers' field conditions in Solapur district is limited. Therefore, the present investigation was undertaken to evaluate the performance of Phule Vikrant (Phule G-0405) under irrigated conditions in Solapur district.

Materials and Methods

The on-farm trials were conducted during the rabi season of 2020-2021, 2021-2022 and 2022-2023 in selected villages of Solapur district, Maharashtra. The district falls under the scarcity zone and experiences a semi-arid climate with an average annual rainfall of about 550–600 mm, mostly received during the southwest monsoon. The soils of the experimental fields were medium to deep black soils with good moisture-holding capacity, typical of chickpea-growing areas in Solapur (Patil *et al.*, 2017) ^[12]. Two treatments were evaluated i.e. T₁: Chickpea variety *Phule Vikrant* (Phule G-0405) under recommended package of practices (irrigated) and T₂: Farmer's practice (local chickpea variety under irrigated condition). Each treatment plot covered an area of 0.4 ha and was managed by the participating farmers with technical guidance from subject matter specialist.

Sowing was carried out during the first fortnight of November using a seed rate of 75 kg ha⁻¹ with a spacing of 30 × 10 cm. A basal fertilizer dose of 25:50:30 NPK kg ha⁻¹ was applied as per the recommended package of practices for chickpea (MPKV, Rahuri 2020) ^[11]. Integrated weed management included application of pre-emergence weedicide i.e. Pendimethalin 2.5 Liter ha⁻¹ followed by hand weeding at 25–30 days after sowing. For controlling weed and moisture conservation hand hoeing was done at 20 days after sowing and at 30 days after sowing. Irrigation was provided through sprinkler at critical growth stages, namely branching, flowering, pod formation, and pod filling stages. Supplemental irrigation during these stages is known to significantly improve chickpea productivity under semi-arid conditions (Kumar *et al.*, 2020) ^[8]. Observations on growth parameters, yield attributes, grain yield, and disease

incidence were recorded using standard methodologies. Water use efficiency was calculated as grain yield per unit of total water applied, following Howell (2001) ^[5]. Economic analysis was performed to estimate cost of cultivation, gross returns, net returns, and benefit–cost ratio based on prevailing market prices. In the demonstration, one control plot was also kept where farmers practices was carried out. The demonstration were conducted to study the technology gap between the potential yield and demonstrated yield, extension gap between demonstrated yield and yield under existing practice and technology index. The yield data were collected from both the demonstration and farmers practice by random crop cutting method and analyzed by using simple statistical tools. The percent increase yield, technology gap, extension gap and technology index were calculated by using following formula as per Samui *et al.*, (2000) ^[16], as given below-

$$\text{Percent increase in yield} = \frac{\text{Demonstration yield} - \text{farmers practice yield}}{\text{farmers practice yield}} \times 100$$

$$\text{Technology gap} = \text{Potential yield} - \text{Demonstration yield}$$

$$\text{Extension gap} = \text{Demonstration yield} - \text{farmers practice plot yield}$$

$$\text{Technology index (\%)} = \frac{\text{Technology gap}}{\text{potential yield}} \times 100$$

Results and Discussion

Growth and Yield Attributes

The Data presented in (Table 1) indicated that the on farm trials of chickpea variety *Phule Vikrant* (Phule G-0405) has given good impact. The chickpea variety *Phule Vikrant* (Phule G-0405) exhibited better vegetative growth in terms of plant height and number of branches per plant compared to the local cultivar. The average plant height of on farm trial was 46.33 cm which was significantly more than the farmers practice 41.33cm. The improved growth under irrigated conditions may be attributed to efficient utilization of moisture and nutrients, as also reported by Singh *et al.* (2018) ^[14]. The variety attained flowering and maturity slightly earlier than the farmer's variety, which is advantageous under the terminal heat stress conditions commonly observed in Solapur district. Higher yield attributes, including number of pods per plant and test weight, were recorded in *Phule Vikrant* (Phule G-0405). The improved yield components resulted in significantly higher grain yield compared to the farmer's practice. Similar yield advantages of improved chickpea varieties under irrigated conditions have been reported by Kumar *et al.* (2020) ^[9] and Meena *et al.* (2019) ^[10]. Water use efficiency was higher in *Phule Vikrant* (Phule G-0405) due to increased grain yield per unit of water applied. Efficient water utilization is particularly important in the scarcity zone of Solapur district, where irrigation water availability is limited (Howell, 2001) ^[5].

Table 1: Growth and Yield attributes in on farm trial of chickpea var. *Phule Vikrant* (Phule G-0405) and farmers practice during 2020-2021, 2021-2022 and 2022-2023

0	Average seed yield (qha ⁻¹)		Plant height (cm)		Branches per plant (Nos.)	
	T ₁ :Demo	T ₂ :Farmers Practice	T ₁ :Demo	T ₂ :Farmers Practice	T ₁ :Demo	T ₂ :Farmers Practice
2020-2021	20.60	16.25	45	40	17	14
2021-2022	22.02	17.00	46	41	19	15
2022-2023	23.90	18.80	48	43	20	17
Mean	22.17	17.35	46.33	41.33	18.66	15.33

Technology gap

The results of on farm trial and potential yield of chickpea variety *Phule Vikrant* (Phule G-0405) were compared to estimate the yield gaps which were further categorized in to technology gap and technology index. The findings of the assessment showed that the technology gap for chickpea variety *Phule Vikrant* (Phule G-0405) was 4.4 qha⁻¹, 2.98 qha⁻¹ and 1.1 qha⁻¹ during rabi 2020-2021, 2021-2022 and 2022-2023 respectively. And average technology gap was 2.82 qha⁻¹ over the three years (Table 2). The data presented in table 2 clearly indicated that the technology gap exists even if the trials were conducted under training and the direct supervision of scientists. Technology gap may be attributed to the variation in the soil fertility status, rainfall, water holding capacity of soil, location specific crop management problems, local weather conditions as well as the different locations of demonstration plots every year.

Extension gap

The extension gap refers to the differences between demonstration yields to existing farmer practice yields. Extension yield gaps signify unawareness among the farmers for the adoption of new technologies (Kumar *et al.* 2019, Choudhary *et al.* 2014) ^[9, 1]. The extension gap was 4.35 qha⁻¹, 5.02 qha⁻¹ and 5.1 qha⁻¹ for the years 2020-2021, 2021-2022 and 2022-2023 respectively and the average value was 4.82 qha⁻¹

over the two years (Table-2). To minimize this extension gap, there is a need to educate the farmers through various extension measures like awareness camp, training and kisan goshti that can play crucial role in bridging this extension gap. The higher the profit with the adoption of improved technologies will eventually lead to the farmers discontinuance of the use of old technology and replace them with the new technology (Hiremath and Naggaraju 2010) ^[7].

Technology Index

The technology index shows the feasibility of the improved technology at the farmer's fields and the lowers the value of the technology index more is the feasibility of the technology (Jeengar *et al.* 2006). The data presented in Table 2 reveals that the technology index was 17.6, 11.92 and 4.4 percent during rabi 2020-2021, 2021-2022 and 2022-2023 respectively and the average value was 11.30 percent. It is due to uneven and erratic rainfall and uncertainty of the weather conditions in the area. The technology index also shows the feasibility of the technological package at the farmer's field. The lower the value of technology index more is the feasibility. The data shows the possibilities to quicken the adoption of demonstrated technical intervention to increase yield performance. A similar opinion was also reported by Dhakad *et al.* (2018) ^[2] and Singh *et al.* (2015) ^[15].

Table 2: Yield, technology gap, extension gap and technology index in on farm trial of chickpea var. *Phule Vikrant* (Phule G-0405) and farmers practice during 2020-2021, 2021-2022 and 2022-2023

Year	Potential Yield (qha ⁻¹)	Average seed yield (qha ⁻¹)		Percent increase	Technology gap (qha ⁻¹)	Extension gap (qha ⁻¹)	Technology index (%)
		T ₁ : Demo	T ₂ : Farmers Practice				
2020-2021	25.00	20.60	16.25	26.15	4.4	4.35	17.6
2021-2022	25.00	22.02	17.00	29.52	2.98	5.02	11.92
2022-2023	25.00	23.90	18.80	27.12	1.1	5.1	4.4
Mean	25.00	22.17	17.35	27.59	2.82	4.82	11.30

Economic Analysis

Economic analysis of on farm trial of chickpea variety *Phule Vikrant* (Phule G-0405) and existing farmers practice presented in Table 3. Economic analysis indicated that cultivation of *Phule Vikrant* (Phule G-0405) resulted in higher gross returns, net returns, and benefit-cost ratio compared to the local cultivar. The OFTs plots recorded higher mean gross returns (Rs.113823 /ha) as compared to farmers practice(gross returns Rs.89069). It is evident from the data of the three years that the highest

average net returns of Rs.63656 was recorded with Chickpea variety *Phule Vikrant* (Phule G-0405) as compared to farmers practice of Rs.36336. Economic analysis of the yield performance revealed the average benefit –cost ratio of on farm trial assessment of chickpea variety *Phule Vikrant* (Phule G-0405) was higher 2.26 compared to farmers practice 1.68. The higher profitability can be attributed to increased grain yield without substantial increase in cost of cultivation, corroborating earlier findings by Patil *et al.* (2017) ^[12].

Table 3: Economic performance of On Farm Trial Chickpea var. *Phule Vikrant* (Phule G-0405) and farmers practice during 2020-2021, 2021-2022 and 2022-2023

Year	Gross income Rs./ha.		Net income Rs./ha.		B: C Ratio	
	T ₁ : Demo	T ₂ : Farmers Practice	Demo	Farmers Practice	Demo	Farmers Practice
2020-2021	98800	78000	53000	30900	2.15	1.65
2021-2022	115164	88910	66664	36910	2.37	1.70
2022-2023	127506	100298	71306	41198	2.26	1.69
Mean	113823	89069	63656	36336	2.26	1.68

Discussion

The superior performance of *Phule Vikrant* (Phule G-0405) under irrigated conditions in Solapur district can be attributed to its improved genetic potential, better response to irrigation, and tolerance to local biotic and abiotic stresses. Irrigation at critical stages ensured continuous moisture availability, leading to improved flowering, pod development, and seed filling, as also emphasized by Kumar *et al.* (2020) ^[8]. The consistency of performance across farmers' fields highlights the adaptability and suitability of the variety for large-scale adoption in the

district.

Conclusion

The on-farm trials conducted in Solapur district clearly demonstrated that chickpea variety *Phule Vikrant* (Phule G-0405) is well suited for irrigated conditions of the scarcity zone. The variety recorded higher yield, better water use efficiency, and superior economic returns compared to the farmer's cultivar. Adoption of *Phule Vikrant* (Phule G-0405) along with recommended irrigation scheduling and integrated crop

management practices can significantly enhance chickpea productivity and farm income in Solapur district of Maharashtra.

of Gujarat. International Journal of Current Microbiology and Applied Sciences. 2019;8(8):95-100.

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References

1. Ali M, Gupta S. Carrying capacity of Indian agriculture: Pulse crops. Current Science. 2012;102(6):874-881.
2. Dhakad SS, Asati KP, Chouhan SS, Badaya AK, Kirar KS, Ambawatia GR. Impact of front line demonstration on the yield and economics of chickpea (*Cicer arietinum* L.) in tribal area of Madhya Pradesh, India. International Journal of Current Microbiology and Applied Sciences. 2018;7(5):3662-3666.
3. FAO. FAOSTAT statistical database. Rome: Food and Agriculture Organization of the United Nations; 2022.
4. Government of India. Agricultural statistics at a glance 2023. New Delhi: Directorate of Economics and Statistics, Department of Agriculture and Farmers Welfare, Ministry of Agriculture and Farmers Welfare; 2023.
5. Howell TA. Enhancing water use efficiency in irrigated agriculture. Agronomy Journal. 2001;93:281-289.
6. ICAR-IIPR. Package of practices for pulse crops. Kanpur: Indian Institute of Pulses Research; 2021.
7. Hiremath SM, Nagaraju MV. Evaluation of on farm front line demonstrations on the yield of chilli. Karnataka Journal of Agricultural Sciences. 2010;23(2):341-342.
8. Kumar S, Singh R, Yadav R. Response of chickpea to irrigation scheduling and improved varieties. Journal of Food Legumes. 2020;33(2):89-94.
9. Kumar S, Singh G, Singh NP. Constraints and strategies for enhancing chickpea productivity in India. Indian Journal of Agricultural Sciences. 2021;91(3):321-328.
10. Meena ML, Singh D, Meena HR. Impact of on-farm trials on adoption and productivity of pulse crops. Indian Journal of Extension Education. 2019;55(3):45-50.
11. MPKV. Phule Vikrant: A high yielding chickpea variety. Rahuri: Mahatma Phule Krishi Vidyapeeth; 2019.
12. Patil SB, Jadhav JD, Pawar AS. Chickpea production and economics under semi-arid conditions of Maharashtra. International Journal of Agricultural Sciences. 2017;13(1):120-124.
13. Peoples MB, Brockwell J, Herridge DF, Rochester IJ, Alves BJR, Urquiaga S, *et al.* The contributions of nitrogen-fixing crop legumes to the productivity of agricultural systems. Symbiosis. 2009;48:1-17.
14. Singh G, Sharma S, Verma R. Yield stability of chickpea under varying moisture regimes. Legume Research. 2018;41(4):567-572.
15. Singh AK, Singh SS, Prakash V, Kumar S, Dwivedi SK. Pulses production in India: Present status, bottlenecks and way forward. Journal of Agri Search. 2015;2(2):75-83.
16. Samui SK, Maitra S, Roy DK, Mondal AK, Saha D. Evaluation of frontline demonstration programme on groundnut (*Arachis hypogaea* L.). Journal of Indian Society of Coastal Agricultural Research. 2000;18(2):180-183.
17. Undhad SV, Prajapati VS, Sharma PS, Jadav NB. Impact of frontline demonstration on the yield and economics of chickpea (*Cicer arietinum* L.) production in Rajkot district