

Response of Different Irrigation Scheduling Through Micro Sprinkler on Yield, Quality and Economics of Chickpea (*Cicer arietinum* L.)

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Abstract

A field experiment entitled "Response of different irrigation scheduling through micro sprinkler on yield, quality and economics of chickpea" (*Cicer arietinum* L.) variety Phule Digvijay was conducted at AICRP on pulse Project, MPKV, Rahuri, Dist. Ahmednagar (M.S), India during the year 2016-17. The experiment was laid out in R.B.D. with six irrigation levels treatment replicated four times. Micro-sprinkler irrigation at 0.9 IW/CPE ratio resulted into highest grain yield (23.14 q ha⁻¹) and straw yield (29.84 q ha⁻¹) with harvest index 43.67 per cent. It was 14.21 per cent more chickpea yield than conventional method i.e., surface irrigation method. The treatment T5 i.e. 0.9 IW/CPE ratio resulted into maximum seed protein content (21.25%) and protein yield (4.28 q ha⁻¹) as compared to others. Growing of chickpea with irrigation scheduling at treatment T₅ i.e. 0.9 IW/CPE ratio using micro-sprinkler was beneficial for achieving higher productivity viz., cost of cultivation (52737 Rs ha⁻¹), gross monetary returns (Rs 9554 ha⁻¹), net monetary returns (Rs 42807 ha⁻¹) and B:C ratio (1.41).

Key words : IW:CPE ratio, Micro-sprinkler, Chickpea.

Top three states having largest area production and productivity of chickpea in India during 2016-17 is Madhya Pradesh (28.53 lakh ha area), Maharashtra (14.27 lakh ha area) and Rajasthan (12.82 lakh ha area). In Maharashtra, chickpea is an important pulse crop only next to pigeon pea having area 13.95 lakh ha, production 13.10 lakh tones and average productivity as 933 kg ha⁻¹ (Anon., a, 2017). Important source of protein (20-22%) in South Asia who are largely vegetarians. Rich in fiber, minerals, B-carotene, and lipid fraction is high in unsaturated fatty acids. Improves soil fertility by fixing atmospheric N up to 141 kg ha⁻¹ (Ahlawat *et al.* 1981).

Average global productivity 700-800 kg ha⁻¹. Protein has special importance in our diet and pulses form an important source of protein in the vegetarian diet. It is also good source of vitamin C and mineral. To supplement the need

of protein about 120 g dal is essential in our diet. The protein content in chickpea is 17.7 per cent. It is a good source of amino acid. Amino acids content in 1 gm of chickpea is 0.44 mg N-lysine 0.30 mg thymine 0.15 mg Riboflavin, 2.9 mg niacin (Mane, 2002). Protein calorie malnutrition is observed in infants and young children in developing countries and includes a range of pathological conditions arising due to lack of protein and calories in the diet. Malnutrition affects about 170 million people especially preschool children and nursing mothers of developing countries in Asia and Africa. Pulses provide a major share of protein and calories in Afro-Asian diet. Among the different pulses, chickpea is reported to have higher protein bioavailability.

Material and Methods

The present investigation was conducted during year 2016-17. Randomized block design with six irrigation treatments replicated four

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times at the farm of AICRP on pulses improvement project, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra, India. The experiment comprises of six irrigation levels i.e., T₁ - 0.3 IW/CPE ratio, T₂ - 0.4 IW/CPE ratio, T₃ - 0.6 IW/CPE ratio, T₄ - 0.75 IW/CPE ratio, T₅ - 0.9 IW/CPE ratio and T₆ - Surface irrigation at branching stage (30-35 days) and pod development stage (60-65days). The gross and net plot size were 8.0 m x 8.0 m and 4.0 m x 4.0 m, respectively. The soil of experimental field was medium black clay soil. Soil was medium in available Nitrogen (220 kg ha⁻¹), medium in available phosphorus (12.78 kg ha⁻¹) and high in potassium (430 kg ha⁻¹). Micro sprinkler irrigation system was scheduled on the basis of pan evaporation data in micro sprinkler method irrigation scheduling was done at every 25 mm CPE in each treatment. The Chickpea crop spacing (30 x 10) cm² on 13.11.2016. Spacing of micro-sprinkler was 4 m whereas lateral spacing was (4 x 4) m².

Results and Discussion

1. Yield : From data it was observed that treatment T₅ i.e. 0.9 IW/CPE ratio recorded significantly highest, grain yield (23.14 q ha⁻¹), Straw yield (29.84 q ha⁻¹) and biological yield (52.98 q ha⁻¹) found maximum in T₅ i.e. 0.9 IW/CPE ratio. Harvest Index in treatment T₅ was highest (43.67%). It might be due to more CO₂ assimilation, better respiration, good photosynthesis activity, good nitrogen metabolism, more availability of auxins, gibberellin, kinetin like substance in planting resulting into increase yield. Similar results have been reported by Sandhu and Parihar (1978) and Nimbalkar (2008).

2. Quality parameter:

Protein content in seed: The mean protein content in seed was 20.42 per cent.

Effect of irrigation regimes: The

maximum protein content in seed was 21.25 per cent in irrigation treatment T₅ i.e. irrigation with micro-sprinkler at 0.9 IW/CPE ratio and significantly superior over all other treatments. This might be due to dilution effect because production was higher with the similar quantity of nutrient available in the soil. The protein content decreased with increasing the irrigations. Similar results were reported by Kulhare *et al.* (1988).

Table 1. Effect of different irrigation scheduling through micro sprinkler on grain and straw yield q ha⁻¹ and harvest index of chickpea (2016-17)

Irrigation treatments	Grain yield (q ha ⁻¹)	Straw yield (q ha ⁻¹)	Biological yield (q ha ⁻¹)	Harvest Index (%)
T ₁ : 0.3 IW/CPE ratio	16.22	24.14	40.37	40.18
T ₂ : 0.4 IW/CPE ratio	16.66	24.93	41.60	40.06
T ₃ : 0.6 IW/CPE ratio	18.68	26.90	45.58	40.98
T ₄ : 0.75 IW/CPE ratio	19.73	27.69	47.43	41.98
T ₅ : 0.9 IW/CPE ratio	23.14	29.84	52.98	43.67
T ₆ : Surface Irrigation	19.85	28.27	49.13	40.41
S. Em ±	0.32	1.02	1.00	1.18
CD at 5%	0.98	3.07	3.01	NS
General mean	19.04	26.96	46.18	41.24

Table 2. Protein percent and protein yield of chickpea as influenced by various irrigation scheduling treatments of chickpea (2016-17)

Irrigation treatments	Protein Per cent (%)	Protein yield (q ha ⁻¹)
T ₁ : 0.3 IW/CPE ratio	19.90	3.22
T ₂ : 0.4 IW/CPE ratio	20.05	3.34
T ₃ : 0.6 IW/CPE ratio	20.18	3.77
T ₄ : 0.75 IW/CPE ratio	20.52	4.04
T ₅ : 0.9 IW/CPE ratio	21.25	4.28
T ₆ : Surface Irrigation	20.63	4.09
S. Em ±	0.10	0.07
CD at 5%	0.29	0.21
General mean	20.42	3.78

Table 3. Economics of chickpea as influenced by various irrigation scheduling treatments (2016-17)

Irrigation treatments	Fixed cost (ha ⁻¹)	Operational cost (ha ⁻¹)	Cost of cultivation (ha ⁻¹)	Gross monetary returns (ha ⁻¹)	Net monetary returns	B:C ratio
T ₁ : 0.3 IW/CPE ratio	7703	45034	52737	66495	13758	1.26
T ₂ : 0.4 IW/CPE ratio	7703	45034	52737	69054	16317	1.31
T ₃ : 0.6 IW/CPE ratio	7703	45034	52737	80927	28190	1.53
T ₄ : 0.75 IW/CPE ratio	7703	45034	52737	82545	29808	1.57
T ₅ : 0.9 IW/CPE ratio	7703	45034	52737	95544	42807	1.81
T ₆ : Surface Irrigation	1480	45034	46534	81241	34707	1.75
Mean	6665.83	45034	51703	79301	27597	1.54

Protein yield per hectare: The maximum protein yield per hectare was (4.28 q ha⁻¹) recorded in treatment T₅ i.e. irrigation with micro-sprinkler at 0.9 IW/CPE ratio and significantly superior over all other treatments. Similar results have been reported by More (1970).

3. Economics: The cost of cultivation per hectare (Rs 52737 ha⁻¹) was recorded in treatment T₁, T₂, T₃, T₄ and T₅ i.e. irrigation at 0.3, 0.4, 0.6, 0.75 and 0.9 IW/CPE ratio respectively. The B:C ratio of treatment T₅ i.e. irrigation at 0.9 IW/CPE ratio was maximum (1.81) as compared to treatment T₁ i.e. irrigation at 0.3 IW/CPE ratio irrigation treatment (1.26). In case of irrigation treatment for chickpea gross monetary return per hectare was maximum (Rs 95544 ha⁻¹) in treatment T₅ i.e. irrigation at 0.9 IW/CPE ratio over rest of irrigation. In case of irrigation treatment for chickpea the maximum net monetary return obtained from treatment T₅ i.e. irrigation at 0.9 IW/CPE ratio (Rs 42807 ha⁻¹). The maximum B:C ratio was observed in treatment T₅ i.e. irrigation at 0.9 IW/CPE ratio (1.81). Similar results were reported by Gite (1999), Schwanki (1999) and Srivastava *et al.* (1999).

Conclusion

The application of irrigation in treatment T₅ i.e. irrigation at 0.9 IW/CPE ratio showed favourable effects on growth and yield contributing characters of chickpea resulting in the higher grain yield (23.14 q ha⁻¹), gross monetary returns (Rs 95544 ha⁻¹), net monetary returns (Rs 42807 ha⁻¹) and B:C ratio (1.81) in sandy clay loam soil under semi-arid zone in rabi season. The highest water use efficiency (9.70 kg ha⁻¹ mm) was observed when irrigation was applied at treatment T₁ i.e. 0.3 IW/CPE ratio followed by treatment T₂ 0.4 IW/CPE ratio (8.32 kg ha⁻¹ mm).

References

- Ahlawat, J. P. S., Singh, A., Saraf, C. S. 1981. Effects of winter legumes on the nitrogen economy and productivity of succeeding cereals. *Exp. Agric.* 17: 55-62.
- Anonymous, 2017. Economic survey of Maharashtra Economics, Statistics, Govt. of Maharashtra, Mumbai.
- Gite, D. R. 1999. Evaluation of different micro irrigation systems and planting layouts for rabi onion M.Sc. (agri.) Thesis Mahatma Phule Krishi Vidyapeeth, Rahuri. (M.S.)
- Kulhare, P. S., Tiwari, K. P., Saran, R. N. and Dixit, J. P. 1988. Effect of irrigation scheduling and phosphorus dose of chickpea (*Cicer arietinum* L.) in deep vertisols. *Indian J. Agric. Sci.* 58 (2): 911-914.
- Mane, 2002. Effect of moisture regimes and potash level on

- growth and yield of chickpea. M.Sc. (Agri.), thesis submitted to Mahatma Phule Krishi Vidyapeeth, Rahuri (M.S.), India.
- More, M. S. 1970. Studies on effect of varying plant densities, levels of nitrogen and phosphorus fertilization and irrigation frequencies on the growth and yield of gram (*Cicer arietinum* L.) variety Chaffa.
- Nimbalkar, A. L. 2008. Studies on effect of irrigation scheduling and planting layout on growth and yield of chickpea. M.Sc. (Agri.) thesis submitted to Mahatma Phule Krishi Vidyapeeth, Rahuri (M.S.), India.
- Sandhu, B. S., Parihar, S. S., Khera, K. L. and Sandhu, K. S. 1978. Scheduling irrigation of chickpea. Indian J. Agric. Sci. 48 (8): 486-492.
- Schwanki, L.T., Prichard, B., Hanson and I. Wellman. 1999. Costs of pressurized irrigation vary with system design California agriculture, 53 (5): 14-20.
- Srivastava, P., Chauhan, H. S. and Srivastava, P. 1999. Comparative performance of cabbage under different irrigation methods. J. of Applied horticulture, Lucknow,1(2): 137-138
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