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Growth and yield of potato influenced by irrigation regimes, planting layout and fertilizer levels

R.R. NIMBALKAR, B.A.SHINDE*, M.M. CHANDANKAR AND S.M. EKATPURE[1]
Department of Agronomy, Ratnai College of Agriculture, Akluj, SOLAPUR (M.S.) INDIA

ABSTRACT

Growth contributing characters in potato (cv. KUFRI JYOTI) *viz*., plant height, spread, number of leaves, number of branches and total dry matter weight and yield contributing characters *viz.,* number of tubers plant^{-1}, size of potato, weight of tuber plant^{-1}, tuber yield, haulm weight ha^{-1} significantly increased with the application of 50mm CPE irrigation regimes with normal planting on ridges and furrows and at higher fertilizer levels 160:80:80 kg NPK ha^{-1}.

Key words : Kufri jyoti, Irrigation regimes planting layouts, Fertilizer levels

INTRODUCTION

Potato (*Solanum tuberosum* L.) is an important crop of the world in vegetable. It is widely grown in world on large scale, ranking on fourth in food production after wheat maize and rice. The district of North Satara and Poona which lie in the jurisdiction of Mahatma Phule Krishi Vidyapeeth, Rahuri are the most important growing areas and have 80 per cent of total area under the crop in the state. The plains of Maharashtra are well suited for increasing the area under potato crop.

As the potato crop is susceptible to the excess and shortage of irrigation water the optimum level of irrigation water should be applied at particular time. A systematic attempt has not been made so far to relate yield with climatic data and different levels of irrigation water on the basis of cumulative pan evaporation for potato crop in this region. Similarly, the information regarding the performance of potato under varied rows spacing and planting systems with surface irrigation under Rahuri conditions is to be standardized through investigation. Similarly, fertilizer application is needed to meet the nutrient requirement of potato crop in most of the Indian soils.

Potato which is underground tuber crop needs more nutrient as compared to cereals. Nutrient management is an important agronomic factor responsible for increasing the yield of potato and the quality of potato.

In view of the above considerations, an experiment entitled. "Effect of irrigation regimes, planting layouts and fertilizer levels on growth and yield of potato (cv. KUFRI JYOTI)" was planned during *Rabi* 1998-99.

MATERIALS AND METHODS

The field experiment was conducted at the Institutional farm of interfaculty Department of Irrigation Water Management, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar during *Rabi* 1998. The soil was sandy clay loam, low in available nitrogen (146.20 kg ha^{-1}) and phosphorus (10.82 kg ha^{-1}) and high in potassium (252.10 kg ha^{-1}) with slightly alkaline in reaction (pH 8.1). The experiment was laid out in Factorial Randomized Block Design (F.R.B.D.).with twelve treatment combinations including three fertilizer levels *viz*., 80:40:40 kg NPK ha^{-1}, 120:60:60 kg NPK ha^{-1} and 160:80:80 kg NPK ha^{-1}.two irrigation regimes at 50 mm CPE, at 6 cm depth and irrigation at 75 mm CPE at 8 cm depth, also again there were two treatments of planting layouts for potato crop *i.e.* ridges and furrows and broad bed furrows with three replications. The gross plot size was 6.0 x 4.8 m^2 while net plot size was 5.40 x 3.60 m^2, respectively.

RESULTS AND DISCUSSION

Biometric observations on growth attributes were recorded at harvest in (Table 1). The height of plant was progressively increased with the advancement in the age of crop, maximum height of 42.98 cm was recorded at 50 mm CPE than 75 mm CPE. Ingale and Dahatonde (1975) reported similar results in potato when irrigation were applied at 40 mm CPE than 60 mm. Similarly, plant height was higher under ridges and furrows than broad bed furrows. Plant height was also higher at 160:80:80 kg NPK/ha of fertilizer level than lower levels of fertilize *i.e.* 80:40:40 NPK and 120:60:60 kg NPK/ha. Ingale and Dahtonde (1975) reported similar results with the application of 100:100:50 NPK kg ha^{-1}. The difference in spread of the plant due to irrigation regimes were statistically significant at all stage of crop growth however the maximum plant spread was observed as 50 mm CPE (41.50 cm) than 75 mm PCE (39.33 mm). Plant spread in

*** Author for correspondence.**
[1] Department of Extension Education, Ratnai College of Agriculture, Akluj, SOLAPUR (M.S.) INDIA

ridges and furrows and in broad bed furrows at harvest were 41.39 and 39.43 cm, respectively. Similar results were reported by Tarade (1984) in groundnut. The mean number of leaves per plant increased with an advancement in the age of crop till harvest of crop. The number of leaves were maximum at 50 mm CPE (*i.e.* 40.76 cm) than 75 mm CPE (*i.e.* 37.31 cm) at harvest. Girase (1996) reported similar results in cabbage indicating number of leaves per plant goes on increasing rapidly and significantly higher number of leaves per plant were recorded in treatments receiving irrigation at 50mm CPE at 10 days interval. The number of leaves per plant recorded in treatment 75 mm CPE were significatly lower. The number of leaves per plant increased significantly and were maximum (39.70) at harvest in ridges and furrows than broad bed furrows (38.38). Girase (1996) observed similar results in cabbage and reported that at harvest the number of leaves per plant were 14.14 and 13.55 in ridges and furrows and in flat beds, respectively. The difference in mean number of leaves per plant at harvest were statistically significant due to different levels of fertilizers. Maximum numbers of leaves were observed at 160:80:80 kg NPK/ha (41.23) than at 80:40:40 kg NPK/ ha (36.93) and 120:60:60 kg NPK/ha (38.95). Similarly the difference in mean number of branches recorded at harvest stage of crop growth were observed, maximum number of branches were at 50 mm (CPE (5.84) than 75 mm CPE (3.83). The number of branches were maximum at normal planting on ridges and furrows (5.41) than the broad bed furrows (4.26). However maximum number of branches were observed at higher dose of 160:80:80 kg NPK/ha (5.91). The dry matter of plant increased with an advancement in the age of crop. The mean dry matter accumulation at harvest was significantly higher in 50 mm CPE (54.73) than 75 mm CPE (52.68). The dry matter production increased with the advancement in the age of the crop upto harvest due to different planting layouts. It was significantly higher in normal planting of ridges and furrows (54.46) than broad bed furrows (52.96) (Table 1).

Increase in vigour as measured in terms of plant height, plant spread, number of leaves, number of branches due to normal planting on ridges and furrows compared to broad bed furrows was probably due to efficient utilization of radiant energy, proper aeration, more availability of water and nutrient which would have increased the photosynthesis ultimately carbohydrates resulting in increased dry matter production per plant. Similar results were reported by Tarade (1984) in groundnut. The maximum dry matter production at harvest was observed at 160:80:80 kg NPK/ha (55.38) than 80:40:40 kg NPK/ha (52.28) and 120:60:60 kg NPK/

Table 1 : Mean growth components in potato (Var. KUFRI JYOTI) as influenced by different treatments

Treatment details	Mean growth components				
	Plant height (cm)	Plant spread (cm)	No. of leaves plant^{-1}	No. of branches plant^{-1}	Total dry matter (g)
Irrigation regimes					
50 mm CPE	42.98	41.50	40.76	5.84	54.73
75 mm CPE	40.51	39.33	37.31	3.83	52.68
S.E. ±	0.20	0.25	0.21	0.25	0.17
C.D. (P=0.05)	0.57	0.75	0.62	0.73	0.51
Planting layouts					
Ridges and furrows	42.35	41.39	39.70	5.41	54.46
Broad bed furrows	41.14	39.43	38.38	4.26	52.96
S.E. ±	0.20	0.25	0.21	0.25	0.17
C.D. (P=0.05)	0.57	0.75	0.62	0.73	0.51
Fertilizer levels NPK kg/ha					
80:40:40	40.36	37.91	36.93	3.66	52.28
120:60:60	41.41	40.22	38.95	4.93	53.47
160:80:80	43.46	43.11	41.23	5.91	55.38
S.E. ±	0.24	0.31	0.26	0.31	0.21
C.D. (P=0.05)	0.70	0.91	0.76	0.89	0.62
Interaction	NS	NS	NS	NS	NS
Mean	41.74	40.41	29.37	4.84	53.71

NS-Non significant

ha (53.47). Singh and Paliwal (1978) reported that shoot dry matter weight per plant was maximum under higher dose of fertilizer 180:120:120 kg NPK ha^{-1} and was found superior as compared to lower levels tried.

The data pertaining to yield and yield contributing characters in potato (Kufri jyoti) as influenced by different treatments are presented, in Table 2. The mean number of tubers per plant was maximum at 50 mm CPE (5.14) than 75 mm CPE (3.32) at harvest. The number of tubers per plant was higher in ridges and furrows (4.83) than broad bed furrows (3.63). At 160:80:80: kg NPK/ha fertilizer level, the number of tubers per plant was maximum (5.54) than lower levels of fertilizer. Singh and Paliwal. (1978) reported higher number of tubers per plant at 140:50:50 kg NPK/ha than 70 kg N/ha.

Size of tubers per plant was higher at 50 mm CPE (15.81 cm) than 75 mm CPE (13.90 cm) at harvest, also the size of tubers per plant was higher in normal planting (15.00cm) as compared to broad bed furrows (13.91 cm) at harvest. Similar trends was noticed in single row planting and double row planting in potato crop in Modinapuram (Anonymous, 1990). The maximum size of tubers per plant was observed at 160:80:80 kg NPK/ha (16.20 cm) than lower levels of fertilizer.

The maximum weight of tubers per plant was observed at 50 mm CPE (314.03) irrigation than at 75 mm CPE irrigation (286.19g) at harvest. Similarly the weight of tubers per plant was higher in ridges and furrows (290.13 g) than broad bed furrows (287.05 g). The maximum weight of tubers per plant was observed with 160:80:80 kg NPK/ha (314.03 g) than lower levels of fertilizer (Table 2).

It is interesting to note that irrigation regimes had spectacular effects on production of tuber yield. Irrigation at 50 mm CPE, produced 16.68 t/ha than at 75 mm CPE (15.22 t/ha) the yield of tubers.

The potato tuber yield was higher in ridges and furrows (16.76 t/ha) than broad bed furrows (15.14 t/ha). The development of tuber when grown on ridges and furrows was better. This might be due to uniform distribution of soil moisture and efficient use of solar energy under normal planting as compared to broad bed furrows. The potato tuber yield was higher in 160:80:80 kg NPK/ha levels of fertilizer (17.68 t/ha) than at 80:40:40 kg NPK/ha (13.51 t/ha) and 120:60:60 kg NPK/ha (16.92 t/ha). Grewal and Singh (1978) also obtained higher tuber yield at higher levels of fertilizer (180:100:100 kg NPK/ha).

The mean haulm weight was significantly higher at 50 mm CPE (7.41q/ha) than at 75 mm CPE (6.59 q/ha) Singh and Paliwal (1978) reported similar results and indicated that haulm weight was maximum at 40 mm CPE

Table 2 : Mean yield components in potato (Var. KUFRI JYOTI) as influenced by different treatments

Treatments	Mean growth components				
	No of tubers $plant^{1}$	Size of tuber $plant^{-1}$ (cm)	Weight of tuber $plant^{-1}$ (g)	Tuber yield (t ha^{-1})	Haulm weight (q ha^{-1})
Irrigation regimes					
50 mm CPE	5.14	15.81	314.03	16.68	7.41
75 mm CPE	3.32	13.90	286.19	15.22	6.59
S.E. ±	0.13	0.20	0.29	0.44	6.44
C.D. (P=0.05)	0.38	0.60	0.86	1.30	1.28
Planting layouts					
Ridges and furrows	4.83	15.00	290.13	16.76	7.54
Broad bed furrows	3.63	13.91	287.05	15.14	6.47
S.E. ±	0.13	0.20	0.29	0.44	0.44
C.D. (P=0.05)	0.38	0.60	0.86	1.30	1.28
Fertilizer levels NPK kg/ha					
80:40:40	2.99	12.94	284.44	13.51	5.50
120:60:60	4.15	14.18	288.60	16.92	7.91
160:80:80	5.54	16.20	292.73	17.68	8.25
S.E. ±	0.16	0.25	0.36	0.54	0.54
C.D. (P=0.05)	0.47	0.73	1.05	1.59	1.59
Interaction	NS	NS	NS	NS	NS
Mean	4.23	14.45	291.87	15.95	7.00

NS-Non significant

than 60 mm CPE. The mean haulm weight was significantly higher in ridges and furrows (7.54 q/ha) than broad bed furrows (6.47 q/ha). Similarly mean haulm weight was significantly higher at 160:80:80 kg NPK/ha (8.25 q/ha) than at 80:40:40 kg NPK/ha (5.50 q/ha). Krishnappa *et al.* (1979) observed that higher dose of 180 kg N 50 kg P_2O_5 and 50 kg K_2O per hectare increased the haulm weight (15.45 q/ha) over control. In this investigation, interaction effects between different factors in respect of growth, yield and yield contributing characters were found to be not significant.

REFERENCES

Anonymous (1990). Annual report of central potato Research Station, Modinapuram, pp. 52-53.

Girase, P.P. (1996). Effect of irrigation schedules and planting layouts on growth and yield of cabbage (*Brassica oleraceae* L.) cv. GOLDEN ACRE in M.Sc. (Ag.) Thesis, Mahatma Phule Krishi Vidyapeeth, Rahuri, Ahmednagar (M.S.).

Grewal, S.S. and Singh, N.T. (1978). Effect of different moisture on soil temperature and the yield and quality of potatoes in Northen India. *Indian J. Agron.,* **23** (2) : 130-136.

Ingale and Dahatonde (1975). Response of potato to ranging levels of irrigations and NPK fertilization. *Indian J. Agron.,* **20** (1) : 62-64.

Krishnappa, K.S. and Muddappa, P. and Gowda (1979). Effect of nitrogen application with and without PK on potato yield in Red soils *J. Indian Potato Asso.,* **6** (2) : 114-118.

Singh, U.B. and Paliwal, S.K. (1978). Effect of irrigation and fertilizer application on potato tuber production in chambal command. *Kota. J. Indian Potato Asso.,* **5** (1) L: 21-25.

Tarade, N.R. (1984). Studies on growth, yield and quality performance of bunch type groundnut FSB-7-2 as influenced by planting layouts, between row spacing and plant population under summer condition. M.Sc. (Ag.). Thesis, Mahatma Phule Krishi Vidyapeeth, Rahuri. pp. 36-38.

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