EFFECT OF WEED AND INTEGRATED NUTRIENT MANAGEMENT ON YIELD OF POTATO (*SOLANUM TUBEROSUM*) UNDER DRIP IRRIGATION

Chandresh Kumar Chandrakar, G.K. Shrivastava, S.K. Dwivedi and Ashish Kumar Chandrakar

Department of Agronomy, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.)

Abstract : A field experiment was conducted at IGKV, Raipur (C.G) during *rabi* 2010-11. The soil of experimental site was clay loam in texture, neutral in soil reaction. The climate of the region is sub humid with an average annual rainfall of 1200-1400 mm. Results revealed that drip irrigation 100 % or 125 % of OPE proved comparable and gave higher growth parameters, yield attributes (number of stolons plant^{-1}, number of tubers plant^{-1}, fresh weight, dry weight of tubers, tuberization efficiency) and total tuber yield of potato crop as compared to furrow irrigation. The herbicide Metribuzin (500 g a.i. ha^{-1}PE) proved better among other weed management practices recorded the maximum growth parameters, yield attributes (number of stolons plant^{-1}, number of tubers plant^{-1}, fresh weight, dry weight of tubers, tuberization efficiency) and total tuber yield of potato crop. Application of 75% N inorganic fertilizer + 25 % N organic (Poultry manure) + PSB + Azotobactor produced significantly highest growth parameters, yield attributes (number of stolons plant^{-1}, number of tubers plant^{-1}, fresh weight & dry weight of tubers, tuberization efficiency) and total tuber yield.

Keywords : Drip irrigation, Weed management, Integrated nutrient management, Potato

INTRODUCTION

Potato (*Solanum tuberosum*) is the most important food and vegetable cum starch supplying crop of the world. It is one of the most remunerative and profitable crop for the growers due to its higher yield potential within a limited time. Water is the vital source for crop production and is the most limiting factor in Indian agricultural scenario. Though India has the largest irrigation network, the irrigation efficiency has not been achieved more than 40 per cent. Due to water scarcity, the available water resources should be very effectively utilized through water saving irrigation technologies. Hence, further expansion of irrigation may depend upon the adoption of new systems such as pressurized irrigation methods with the limited water resources. Amongst those pressurized irrigation methods, drip irrigation has proved its superiority over other methods of irrigation due to the direct application of water and nutrients in the vicinity of root zone. There are several constraints in potato production, of which weeds often pose a serious problem. Weeds not only compete with crop plants for nutrients, soil moisture, space and sunlight but also serve as an alternative hosts for several insect pest and diseases. Hand weeding and hoeing are common practices followed in India. However, timely weed control may not be possible manually due to non-availability of labours and high rate of wages during peak period of farm operations. Hence, chemical weed control appears to hold a great promise in dealing with effective, timely and economic weed suppression. The overall strategy for increasing potato yields and sustaining them at a high level must include an integrated approach to the management of soil nutrients, along with other complementary measures.

MATERIAL AND METHOD

A field experiment was conducted at IGKV, Raipur (C.G) during *rabi* 2010-11. The soil of experimental site was clay loam in texture, neutral in soil reaction, low in available N, low in available P and high in available K status. The climate of the region is sub humid with an average annual rainfall of 1200-1400 mm. The crop received 63.7 mm rainfall during crop period. The experiment was laid out in split–split plot design with three replications. The treatments consisted of three irrigation schedule i.e. drip irrigation (125 % of OPE), drip irrigation (100 % of OPE) and control (furrow irrigation) as a main plot and four weed management i.e. weedy check, hand weeding (at 25 and 45 DAP) metribuzin (500 g a.i. ha^{-1} PE) and chlorimuron + quizalofop (6 + 50 g a.i ha^{-1}) at 20 DAP as sub plot and four integrated nutrient management i.e. 100 % RDF, 100 % RDF + Micro nutrient (Zinc sulphate 25 kg ha^{-1}), 75 % N inorganic fertilizer + 25 % N poultry manure + PSB + Azatobactor and 50 % N inorganic fertilizer + 50 % N poultry manure + PSB + Azatobactor as sub sub plot. Kufri Chipsona- 2 variety was used for experiment during *rabi* season of 2010-11 .

RESULT AND DISCUSSION

Growth and development

The result revealed that, drip irrigation (125 % of Open pan evaporation) produced significantly higher plant height, number of leaves plant^{-1}, fresh weight of shoot plant^{-1} and Crop growth rate (CGR) as compared to furrow irrigation, however it was statistically at par with drip irrigation (100 % of Open pan evaporation). The main reason of significantly higher growth of potato in drip irrigation is proper supply of water whatever requirement of crop daily. Among weed

management practices, Metribuzin (500 g a.i. ha^{-1}PE) registered significantly higher growth parameters, (plant height, number of leaves plant^{-1}, fresh weight of shoots plant^{-1} and Crop growth rate (CGR)) as compared to weedy check and rest of the treatments. The main reason behind this was due to significant impact of Metribuzin (500g a.i ha^{-1} P.E) which also resulted the maximum weed control efficiency. With the application of this treatment maximum weeds was controlled timely, leading to utilization of maximum resources by potato plants. Among integrated nutrient management, application of 75% N inorganic fertilizer + 25 % N organic (Poultry manure) + PSB + Azotobactor produced significantly higher values of growth attributes i.e. plant height, number of leaves plant^{-1}, fresh weight of shoots plant^{-1} and Crop growth rate (CGR)) than other nutrient management practices. This may be due to an increased availability of nutrients to the plant in the presence of biofertilizers and organic manure (poultry manure). Corroboratory results have also been obtained by Ahmed *et al*. (2011), Kumar *et al*. (2007) and Sarkar *et al*. (2011) (Table-1).

Yield attributes and yield

Irrigation schedule positively influenced the yield attributes and yield. The number of stolons plant^{-1}, number of tubers plant^{-1}and tuber yield were significantly higher under drip irrigation (125 % of open pan evaporation) than control (furrow irrigation) but was at par with drip irrigation (100 % of open pan evaporation). The higher yield attributing characters and yield was noticed in the above treatment which might be due to availability of water in sufficient quantity. Among weed management practices, the number of stolons plant^{-1}, number of tubers plant^{-1}and tuber yield were significantly higher under Metribuzin (500 g a.i. ha^{-1}PE) than weedy check and rest of the treatments. Significantly higher yield attributing characters i.e. number of stolons, tubers and tuber yield was found under treatment 75% N inorganic fertilizer + 25 % N organic (Poultry manure) + PSB + Azotobactor than other nutrient management practices. These findings are in agreement with those reported earlier by Arora *et al*. (2009), Bakeer *et al*. (2009) and Baishya *et al*. (2010) (Table-2).

Table 1: Effect of irrigation schedule, weed and integrated nutrient management on plant height, number of leaves, fresh weight of shoots plant^{-1} at 60 days after planting and CGR at 40-60 DAP of potato crop

Treatment	Plant height (cm)	Number of leaves plant^{-1}	Fresh weight of shoots plant^{-1} (g)	Crop growth rate (g day^{-1})
Irrigation schedule				
I_1 – 100% OPE (Open Pan Evaporation)	42.46	57.34	170.98	12.50
I_2 – 125% OPE	42.56	58.17	176.27	13.46
I_3 – Control (Furrow irrigation)	34.47	44.69	131.12	9.33
SEm±	**0.18**	**0.25**	**2.84**	**0.25**
CD (P = 0.05)	**0.72**	**0.99**	**11.11**	**0.99**
Weed management				
W_0 – Weedy check	35.24	46.98	148.23	9.63
W_1 – Hand weeding at 25 and 45 DAP	41.51	57.99	161.30	13.01
W_2 – Metribuzin (500g a.i ha^{-1}. PE)	43.33	59.27	170.97	13.97
W_3 – Chlorimuron (CMS) + Quizalofop (6+50g a.i ha^{-1}) at 20DAP	39.24	49.36	157.33	10.33
SEm±	**0.28**	**0.41**	**1.15**	**0.11**
CD (P = 0.05)	**0.85**	**1.22**	**3.44**	**0.35**
Integrated nutrient management				
F_1 – 100% RDF	35.40	49.79	151.21	10.42
F_2 - 100% RDF + Micro nutrient (Zinc sulphate 25 kg ha^{-1})	38.49	51.66	154.11	11.28
F_3 – 75% N Inorganic fertilizer + 25% N Poultry manure + PSB + Azotobactor	43.95	59.68	170.61	13.42
F_4 – 50% N Inorganic fertilizer + 50% N Poultry manure + PSB + Azotobactor	41.48	52.48	161.89	11.83
SEm±	**0.21**	**0.30**	**0.96**	**0.19**
CD (P = 0.05)	**0.61**	**0.85**	**2.70**	**0.54**

Table 2: Effect of irrigation schedule, weed and integrated nutrient management on number of stolons, number of tubers and tuber yield of potato crop

Treatment	Number of stolons plant^{-1}	Number of tubers plant^{-1}	Tuber yield (t ha^{-1})
Irrigation schedule			
I_1 – 100% OPE (Open Pan Evaporation)	26.47	12.43	30.16
I_2 – 125% OPE	26.98	13.00	31.02
I_3 – Control (Furrow irrigation)	24.37	9.15	20.74
SEm±	**0.13**	**0.23**	**0.23**
CD (P = 0.05)	**0.53**	**0.90**	**0.91**
Weed management			
W_0 – Weedy check	24.44	10.14	24.81
W_1 – Hand weeding at 25 and 45 DAP	26.35	12.30	28.57
W_2 – Metribuzin (500g a.i ha^{-1}. PE)	26.86	12.95	29.51
W_3 – Chlorimuron (CMS) + Quizalofop (6+50g a.i ha^{-1}) at 20DAP	26.11	10.71	26.33
SEm±	**0.13**	**0.12**	**0.19**
CD (P = 0.05)	**0.39**	**0.37**	**0.57**
Integrated nutrient management			
F_1 – 100% RDF	24.82	10.50	24.85
F_2 - 100% RDF + Micro nutrient (Zinc sulphate 25 kg ha^{-1})	25.51	10.87	26.61
F_3 – 75% N Inorganic fertilizer + 25% N Poultry manure + PSB + Azotobactor	27.70	13.55	30.45
F_4 – 50% N Inorganic fertilizer + 50% N Poultry manure + PSB + Azotobactor	25.73	11.18	27.31
SEm±	**0.16**	**0.18**	**0.273**
CD (P = 0.05)	**0.45**	**0.52**	**0.769**

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