Agric. Sci. Digest., 38 (2) 2018 : 127-130
Print ISSN:0253-150X / Online ISSN:0976-0547

AGRICULTURAL RESEARCH COMMUNICATION CENTRE
www.arccjournals.com

Seed yield and nutrient uptake in late sown toria (*Brassica campestries* var. toria) as influenced by different irrigation and fertilizer levels

Pompy Deka, Kalyan Pathak, Mahima Begum*, Abhijit Sarma and Poran Kishore Dutta[1]

Department of Agronomy,
Assam Agricultural University, Jorhat–785 013, Assam, India.
Received: 08-03-2018 Accepted: 04-06-2018 DOI: 10.18805/ag.D-4735

ABSTRACT

A field experiment was conducted during 2014-15 in the *Rabi* season at Instructional Cum Research Farm of Assam Agricultural University, Jorhat, Assam, India to find the effect of different irrigation schedule and fertilizer levels on seed yield, oil content and nutrient uptake in late sown toria (*Brassica campestries* var. toria) grown after *sali* rice. Result revealed that application of different irrigation and fertilizers has significantly increased the yield of late sown toria over control. Out of different irrigation schedule, application of 6 cm irrigation at 25 and 50DAS recorded the higher seed yield (9.55 q ha^{-1}) which is 16.60, 23.11 and 37.10 percentage higher over the other irrigation schedules *i.e.* 6 cm irrigation at siliqua formation stage (50 DAS), 6 cm irrigation at pre flowering stage (25DAS), rainfed respectively. In case of different fertilizers levels, application of 75-50-50 N-P_2O_5-K_2O kg ha^{-1} produced the highest seed yield (8.72q ha^{-1}) which is statistically *at par* with 60-40-40 N-P_2O_5-K_2O kg ha^{-1} (8.48 q ha^{-1}), but significantly superior than 45-30-30 N-P_2O_5-K_2O kg ha^{-1} (7.10 q ha^{-1}). The oil content was slightly increased with the increase in fertilizer levels, 5.85% and 3.37% oil content was increased with the fertilizes dose 75-50-50 N-P_2O_5-K_2O kg ha^{-1} and 60-40-40 N-P_2O_5-K_2O kgha^{-1}, respectively over 45-30-30 (Control). However irrigation has no any significant role in oil content of late sown toria.

Key words: Late sown toria, Nutrient uptake, Oil content, Seed yield.

INTRODUCTION

In Assam, rapeseed and mustard is the main oilseed crop grown on commercial basis occupying an area of 2.85 lakh hectares with annual production of 1.99 lakh tonnes of seed and productivity 698 kg ha^{-1}(Govt. of Assam 2016) which is very poor as compared to national average productivity. Rainfed cultivation, poor nutrient management and delay in sowing are some of the reason for low productivity of the crop in the state. Rapeseed is usually sown from mid-October to mid-November in Assam. However, in medium low land, clay loam to sandy loam soil the crop is sown late which sometimes goes upto December after harvesting of Sali rice (November) in rice-toria cropping system. Delay in sowing adversely influence the crop performance, mainly due to depletion of soil moisture affecting flowering and early siliqua formation causing poor seed filling. As a result the yield suffers mainly due to moisture stress under poor nutrient supply. Singh *et al.* (1991) also reported that mustard crop was most sensitive to moisture stress from vegetative to early flowering stage when it was grown under a wide variety of limited irrigation conditions. It necessitates development of a suitable irrigation management practice with proper nutrient management to boost up the productivity of the crop since the crop is highly responsive to fertilizers, particularly to nitrogen, phosphorus, and potassium (Allen and Morgan, 1972).

Therefore, the present research was undertaken to determine the suitable schedule of irrigation for late sown toria grown after winter rice, and to find out effective fertilizer dose under irrigated condition.

MATERIALS AND METHODS

A field experiment was conducted during 2014-15 in the *rabi* season at Instructional Cum Research Farm of Assam Agricultural University, Jorhat, Assam, India. The climate of the area is sub-tropical, with an average annual rainfall of 1864.8 mm. Minimum monthly temperature of 9.7^{0}C and maximum monthly temperature of 32.4 ^{0}C are observed in January and August, respectively. During January and March, maximum (morning) and minimum (evening) monthly relative humidity of 94.8% and 61.1% were recorded. The soil of the experimental plots were sandy loam in texture, acidic in reaction (pH 5.8), medium in organic matter (0.68%), low in available N (259.5 kg ha^{-1}), medium in available P (25.70 kg ha^{-1}) and low in available K (137.6 kg ha^{-1}). The treatments consisted of four irrigation levels *viz.*, I_0 - rainfed, I_1- 6 cm irrigation at pre flowering stage [25 days after sowing (DAS)], I_2- 6 cm irrigation at siliqua formation stage (50 DAS), I_3 - 6 cm Irrigation at 25 DAS

*Corresponding author's e-mail and address: mahimabegum25@rediffmail.com Sugarcane Research Station, Assam Agricultural University, Buralikson-785 618. [1]KVK Kokrajhar, Gossaigaon-783360, Assam, India.

and 50 DAS, and three fertilizer levels *viz* F_1- 45-30-30, F_2 - 60-40-40 and F_3 -75-50-50 N-P_2O_5- K_2O kg ha^{-1}, respectively. Borax @ 10 kg ha^{-1} was applied uniformly to all the treatments. The experiment having plots size, 12 m^2 (4 m × 3 m) were laid out in factorial randomized block design with three replication. The nutrients N, P and K were applied in the form of urea, single super phosphate and muriate of potash, respectively. Half of the N and full dose of P_2O_5, K_2O and borax were applied to all the treatments at the time of sowing. Remaining N was applied at 20 days after sowing. After harvest of the winter rice, Toria (JT-90-1) was sown on 15th December, 2014 and harvested on 11th March, 2015. Toria seed was sown in rows at 30 cm spacing. For maintaining the plant population thinning of excess seedlings was done at two weeks after emergence of seedling, maintaining an intra row spacing of 10 cm. Intercultural operations and plant protection measures were taken as and when required. The crop was irrigated as per treatment. Yields were recorded on a whole-plot basis after discarding border plants. For determining the seed oil content (%), seed samples of 10 g each from all the treatments were taken for extraction of oil. The crushed sample was place in a thimble and extracted with light petroleum ether for six hours in a soxhlet extraction unit as per method described by AOAC (1960). The extract was transferred to a weighed flask, the solvent and moisture being removed by heating the flask at 100 – 150°C. Then the flask was cooled and reweighed. The formula used for calculation of percent oil content in seed was as follows:

$$\text{Per cent oil} = \frac{W_2 - W_1}{X} \times 100$$

where,

W_1 = Weight of the empty flask (g)
W_2 = Weight of empty flask + weight of oil (g)
X = Weight of sample taken for extraction (g)

The Nitrogen content in both seed and stover was estimated by modified Kjeldahl method as described by Jackson (1973), Phosphorus was determined colorimetrically by tri-acid digestion and yellow colour method as outlined by Jackson (1973) and Potassium was determined by flame photometer as described by Jackson (1973).

Uptake of each nutrient (N, P and K) was computed as follows:

Nutrient uptake (kg ha^{-1}) =

$$\frac{\text{Per cent nutrient content in grain/straw x yield (kg ha}^{-1})}{100}$$

The data were analyzed statistically and presented in Table 1& 2.

RESULTS AND DISCUSSION

Seed and stover yield: Application of different irrigation regimes significantly increased the seed and stover yield of toria. Out of all irrigation regimes, application of 6 cm irrigation at 25 and 50 DAS recorded higher seed yield (9.55 q ha^{-1}) which is 19.12, 27.01 and 40.72 per cent higher than irrigation at siliqua formation stage (50 DAS) (8.19), at pre flowering stage (25 DAS) (7.70) and rainfed (6.95), respectively. The better uptake of nutrient by plant under this irrigation regime might have increased the seed yield. Beneficial effects of irrigation on yield attributes and seed yield of rapeseed were also reported by Sultana *et al*. (2009); Yadav *et al*. (2010); Piri *et al.* (2011); Sonowal (2012) and Das (2015).

In case of fertilizer levels, seed and stover yield of toria increased significantly with increasing levels fertilizer. Application of 75-50-50 N-P_2O_5-K_2O kgha^{-1} produced the highest seed (8.72q ha^{-1}) and stover yield (19.06q ha^{-1}) which is statistically *at par* with the application of 60-40-40 N-P_2O_5-K_2O kgha^{-1} (8.48 q ha^{-1}, 18.41 q ha^{-1}), but significantly superior than 45-30-30 N-P_2O-K_2O kg ha^{-1} (7.1 q ha^{-1}, 16.86 q ha^{-1}). Higher seed and stover yield of toria with the application of 75-50-50 N-P_2O_5-K_2O kgha^{-1} might be attributed to better plant growth. Finlayson (2007) also reported that changes in NPK level could compensate the yield loss to some extent in the late sown variety of rapeseed

Table 1: Effect of different irrigation schedule and fertilizer levels on yield (q ha^{-1}), oil content (%), Oil Yield (kg ha^{-1})

Treatment	Seed yield(qha^{-1})	Stover yield	Oil content(%)	Oil yield(kgha^{-1})
Irrigation regimes (I)				
I_0 : Rainfed	6.95	16.28	37.34	259.9
I_1: 6 cm irrigation at pre flowering stage (25 DAS)	7.70	17.70	37.48	288.8
I_2 :6 cm irrigation at siliqua formation stage (50 DAS)	8.19	17.87	37.54	307.9
I_3: 6 cm irrigation at 25 and 50 DAS	9.55	20.59	37.77	360.9
SEm±	0.20	0.37	0.80	7.8
CD (P = 0.05)	0.59	1.08	NS	22.9
Fertilizer levels (F)(N-P_2O_5-K_2O kgha^{-1})				
F_1: 45-30-30	7.10	16.86	36.41	258.1
F_2: 60-40-40	8.48	18.41	37.64	319.1
F_3: 75-50-50	8.72	19.06	38.54	336.1
SEm±	0.17	0.32	0.69	6.77
CD (P = 0.05)	0.51	0.94	2.04	19.85

Table 2: Effect of different irrigation schedule and fertilizer levels on nutrient content (%) and nutrient uptake by toria

Treatment	N Content (%)		P Content (%)		K Content (%)		N- uptake (kg ha^{-1})			P –uptake (kg ha^{-1})			K-Uptake(kg ha^{-1})		
	Seed	Stover	Seed	Stover	Seed	Stover	Seed	Stover	Total	Seed	stover	total	Seed	Stover	Total
Irrigation regimes (I)															
I_0 : Rainfed	2.08	0.73	0.42	0.14	0.46	0.54	14.47	11.88	26.35	2.92	2.28	5.20	3.20	8.79	11.99
I_1: 6 cm irrigation at pre flowering stage (25 DAS)	2.12	0.74	0.43	0.14	0.46	0.56	16.33	13.10	29.43	3.31	2.48	5.79	3.54	9.92	13.46
I_2 :6 cm irrigation at siliqua formation stage (50 DAS)	2.23	0.74	0.44	0.14	0.46	0.56	18.27	13.22	31.50	3.60	2.50	6.10	3.77	10.01	13.78
I_3: 6 cm irrigation at 25 and 50 DAS	2.26	0.75	0.44	0.14	0.47	0.56	21.59	15.44	37.03	4.20	2.88	7.08	4.49	11.54	16.03
SEm±	0.11	0.05	0.01	0.004	0.01	0.02	0.42	0.35	0.80	0.09	0.07	0.15	0.09	0.28	0.34
CD (P = 0.05)	NS	NS	NS	NS	NS	NS	1.23	1.03	2.34	0.26	0.21	0.44	0.26	0.82	1.00
Fertilizer levels (F)($N\text{-}P_2O_5\text{-}K_2O$ kgha^{-1})															
F_1: 45-30-30	2.08	0.73	0.42	0.14	0.46	0.55	14.76	12.31	27.06	2.97	2.36	5.33	3.26	9.25	12.51
F_2: 60-40-40	2.20	0.74	0.44	0.14	0.46	0.56	18.65	13.62	32.26	3.73	2.58	6.31	3.90	10.31	14.21
F_3: 75-50-50	2.25	0.75	0.44	0.14	0.47	0.56	19.61	14.30	33.91	3.84	2.67	6.51	4.12	10.64	14.74
SEm±	0.10	0.04	0.01	0.003	0.01	0.02	0.36	0.30	0.69	0.08	0.06	0.13	0.08	0.24	0.30
CD (P = 0.05)	NS	NS	NS	NS	NS	NS	1.07	0.89	2.04	0.23	0.18	0.38	0.23	0.71	0.87

(*Brassica napus*) under irrigated condition. Highest seed and stover yield of rapeseed obtained with application of 50 kg K_2Oha^{-1} being *at par* with 40 kg K_2Oha^{-1} was also recorded by Sonowal (2012).

Oil content (%) and oil yield: Application of different irrigation regimes has no significant effect on oil content of seed. However, application of 6 cm irrigation each at 25 and 50 DAS recorded the higher oil yield over other irrigation levels. This is to higher seed yield produced by this treatment which helps in more production of oil. However, increase in fertilizer dose increases the oil content of seed. The higher oil content was recorded by the application of 75-50-50 N-P_2O_5-K_2O kg ha^{-1}(38.54%) which is statistically *at par* with 60-40-40 N-P_2O_5-K_2O kg ha^{-1} (37.64%), but superior than 45-30-30 N-P_2O_5-K_2O kgha^{-1} (36.41%) and simultaneously the oil yield was also increased. Luikham *et al*. (2006) also reported that the highest seed yield, oil content and oil yield was associated with the application of higher phosphorus @ 60 kg P_2O_5 ha^{-1}.

Nutrient content and uptake: N, P and K-content in seed and stover of toria did not vary significantly due to application of different irrigation treatment. However, application of irrigation resulted in significantly higher N, P and K-uptake by seed and stover than rainfed crop. Higher N, P and K uptake by seed (21.59 kg ha^{-1}, 4.20 kg ha^{-1} and 4.49 kg ha^{-1}, respectively) was recorded when two irrigations *i.e.,* 6 cm irrigation each at 25 and 50 DAS was applied. This differences in nutrient uptake by toria might be explained on the basis of differences in biomass (both seed and stover) brought about by different irrigational regimes. Results of almost similar nature have also been reported by Yadav *et al*. (1996) and Debbarma (2013).

Further N, P and K-uptake by toria also increased with increasing level of fertilizer. This might be due to higher biomass production with the application of 75-50-50 N-P_2O_5-K_2O kgha^{-1} resulting in increased uptake of N, P and K (33.91kg ha^{-1}, 6.51kg ha^{-1}, 14.74kg ha^{-1}) which is statistically *at par* with 60-40-40 N-P_2O_5-K_2O kgha^{-1} (32.26kg ha^{-1}, 6.31 kg ha^{-1}, 14.21 kg ha^{-1}) and both are significantly superior than 45-30-30 N-P_2O_5-K_2O kgha^{-1} (27.06 kg ha^{-1}, 5.33 kg ha^{-1}, 12.51 kg ha^{-1}). This results Corroborates the findings reported by Kumar *et al*. (2002) and Kumar (2015).

CONCLUSION

From the present investigation it can be concluded that application of two irrigations *i.e.,* 6 cm irrigation each at 25 and 50 DAS can be applied for better yield of late sown toria and the fertizer dose can also be increased up to 60-40-40 N-P_2O_5-K_2O kg ha^{-1} to increase the yield and oil content under the prevailing condition.

REFERENCES

Allen E.J. and Morgan D.G. (1972). A quantitative analysis of the effect of nitrogen on the growth, development and yield of oilseed rape. *J. Agri. Sci*., (Camb.) **78**: 315-324.

A.O.A.C. (1960). Official Method of Analysis (10th ed.). Association of Official Agricultural Chemists, Washington D. C.

Das, J. (2015). Response of rapeseed (*Brassica campestris* var. toria) varieties to varying levels of irrigation under late sown condition. M.Sc. (Agri.) Thesis submitted to the Department of Agronomy, Assam Agricultural University, Jorhat.

Debbarma, J. B. (2013). Studies on intercropping of rapeseed (*Brassica campestris* L. var. toria) + french bean (*Phaseolus vulgaris*) system under irrigated condition. M.Sc. (Agri.) Thesis submitted to the Department of Agronomy, Assam Agricultural University, Jorhat

Jackson, M.L. (1973). Soil Chemical Analysis. Prentice Hall of India Pvt. Ltd., New Delhi.

Finalyson, G. (2007). Effect of NPK levels on yield of rapeseed (*Brassica napus*). *International J. of Agricultural Science*. **3**(8): 445-447.

Kumar, R. (2015). Effects of NPKS on growth, yield and quality of late sown *toria* varieties (*Brassica rapa* l. Var. *Toria*) under rainfed condition of north east India. *Bangladesh J. Bot*. **44**(4): 521-528,

Kumar, D.; Singh, S.; Sharma, S.N. and Shivay, Y.S. (2002). Effect of levels, sources and time of nitrogen application on N uptake and quality of mustard (*Brassica juncea* L.). *Ann. Agric. Res.* **23**(1): 12-16.

Luikham, E.; Singh, N.A. and Mariam, A.P.S. (2006). Influence of phosphorus and organic manure on yield and quality of late sown rapeseed (*Brassica campestris* var toria) under rainfed condition. *Ann. Agric. Res.* **27**(4): 377-379.

Piri, I.; Nik, M.M.; Tavassoli, A. and Rastegripour, F. (2011). Effect of irrigation intervals and sulphur fertilizer on growth analysis and yield of *Brassica juncea*. *African J. Miocrobiol. Res.* **5:** 3640-3646.

Piri, I. and Sharma, S.N. (2006). Effect of irrigation on growth, yield and moisture use by Indian mustard (*Brassica juncea*). *Ann. Agric. New Series* **27**(4):342-344.

Singh, P.K.; Mishra, A.K.; Imtiyaz, M. (1991). Moisture stress and water use efficiency of mustard. *Agril. Water Mngt*. **20**(3): 245-253.

Sonowal, D. (2012). Performance of *toria* under different levels of irrigation and potassium. M.Sc. (Agri.) Thesis submitted to the Department of Agronomy, Assam Agricultural University, Jorhat.

Sultana, S.; Ruhul, A.A.K.M. and Hasanuzzaman, M. (2009). Growth and yield of rapeseed (*Brassica campestris* L.) varieties as affected by levels of irrigation. *American-Eurasian J. Sci. Res.* **4**(1): 34-39.

Yadav, K.S.; Rajput, R.L.; Verma, O.P. and Yadav, R.P. (1996). Effect of sowing date and irrigaton levels on seed yield and quality of Indian mustard (*Brassica juncea*). *I. Journal of Agronomy.* **41**(2): 275-278.

Yadav, R.P.; Tripathi, M.L. and Trivedi, S.K. (2010). Yield and quality of Indian mustard (*Brassica juncea*) as influenced by irrigation and nutrient levels. *Indian. Journal of Agronomy.* **55**(1): 56-59.