International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2018; 6(4): 15-17

Received: 12-05-2018
Accepted: 17-06-2018

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Effect of irrigation schedules on productivity and water use efficiency in Indian mustard (*Brassica juncea* L.)

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Abstract
A field experiment was conducted during *rabi* season of 2013-2014 on sandy loam soil of student instructional farm (SIF) of C.S. Azad University of Agriculture & Technology, Kanpur (U.P.) to study the effect of various irrigation schedule and sulphur levels on productivity and water use efficiency of Indian mustard [*Brassica juncea* (L.)]. The pH of soil of experiment field was 7.3 with available N_2 129.0, P_2O_5 17.1 and K_2O 187 kg ha^{-1}. The treatment consisted of six irrigation stages IR_0 (no sown irrigation), IR_1 (30-35 DAS), IR_2 (flowering), IR_3 (30-35 DAS and flowering), IR_4 (30-35 and siliqua development) and IR_5 (30-35, flowering + siliqua development) in main plot. And three levels of Sulphur S_0 (no sulphur), S_1 (20 Kg ha^{-1}) and S_2 (30 kg ha^{-1}) in sub plot were tested in split plot design (SPD) with three replications. Results showed that the maximum seed yield was observed with the three irrigation levels IR_5 (30-35 + F + SD) which were higher by 20.47, 25.51, 47.01, 54.65 and 123.90 percent over IR_4, IR_3, IR_2, IR_1 and IR_0 respectively.

Keywords: Irrigation, mustard, siliqua, consumptive use of water, water use efficiency and oil content

Introduction
Oilseeds together occupy 27. of growers, who are mostly small and marginal adopted low standard of management technology viz. substandard seeds, lower dose of inputs like fertilizers, plant protection materials and 45 million ha which accounts for 14% of total cropped area in the country with a production of 24.72 million tones (2006-07), accounting for nearly 5% of the gross national product and 10% of the value of all the agricultural products. Rapeseed and mustard ranks third in area (21%) and production (23%) after the groundnut (*Arachis hypogaea* L.) and soybean (*Glycine max* L. Merr). The per hectare productivity of the rapeseed-mustard is quite low in the country (1152 kg/ha) against the world average of 1400 kg/ ha in world (Piri and Sharma 2006). It is due to majority lack of irrigation facilities. Among them irrigation is one of the important component which improves the crop growth and productivity of rapeseed and mustard. The significant response is in the range of 1-3 irrigations (Singh *et al*., 1994) [5]. Keeping the above facts in view the present investigation was undertaken to study the effect of different level of irrigation on production performance of Indian mustard [*Brassica juncea* (L.) Czernj and Cosson] under irrigated ecosystem' during *rabi* 2007 and 2008.

Materials and Methods
A field experiment was conducted during *rabi* 2013-14 at C.S. Azad University of Agriculture and Technology, Kanpur, Uttar Pradesh, situated 26029' 5"N latitude, 80029'25 83.03°E longitude and at an altitude of 125.9 above mean sea level in the Central plain zone. The soil of the experimental field was sandy loam in texture, alkaline in reaction (pH 7.6), low in organic carbon (0.35%) and available nitrogen (163 kg ha^{-1}), medium in available phosphorus (18.60 kg ha^{-1}), and potassium (203 kg ha^{-1}). The total rainfall received during crop season 2013-14 was 152.4 mm of which 105.6 mm in January, 36.8 mm in February and 20.6 mm in March. Crop experienced foggy weather from mid December to mid January. After pre-sowing irrigation, subsequent irrigations were given as per treatments. First irrigation was given at initiation of branching (35 DAS, second at flowering (65 DAS) and third at siliqua development stage (95 DAS) respectively.

Indian mustard variety – Varuna was sown @ 5 kg seed ha^{-1} on 22th November 2013 with plant geometry of 45×15 cm apart and evaluated in split plot design with three replications. Optimum plant population maintained by thinning operation and planting gaps were filled by re-sowing of seeds or by dibbling methods. The first thinning operation was completed within 15 days stage of crop in which the plants were maintained in single rows, in second thinning intra row plant spacing was maintained at 15 cm apart by removing extra plants from the rows up to 25 days stage of crop. Two weeding and hoeing operation was done in the crop after first irrigation from the point of view to remove the weeds as well as to provide aeration in the plant rhizosphere for proper root development. One spray of monocrotophos was applied to protect the crop saw fly at the 20 DAS. The observations were recorded on the different growth parameters viz. plant height, primary and secondary branches $plant^{-1}$ at maturity, yield attributes, seed yield and economics at harvest. The experimental crop was harvested in the month of March 28. The produce from net plots were harvested in one lot and tied in bundles and allowed to complete sun drying. After that the complete dried material was passes through threshing operation. After threshing and winnowing the clean seeds from each plot were weighed and the weight was recorded as seed yield in kg $plot^{-1}$ and then converted in kg ha^{-1}.

Result and Discussion

Growth Parameter

Application of three irrigation IR_5 (30-35 DAS, Flowering and Siliqua development) significantly increased the plant height number of leaves and primary branches per plant over IR_4, IR_3, IR_2, IR_1 and IR_0 treatments (Table 1). This might be due to the fact that sufficient soil moisture was maintain by providing irrigation, had significant effect on the grain tissue area and higher photosynthetic assimilation, thus as a result plant growth improved with a higher accumulation of dry matter (Lal *et al.* 2013) [2].

Yield and yield attributes

Application of three irrigation IR_5 (30-35 DAS, Flowering and Siliqua development) produced maximum seed (21.45 qha^{-1}), Stover (49.81 qha^{-1}) and biological yield (71.26 qha^{-1}). This might be due to higher photosynthesis and translocation of assimilates toward reproductive structure owing to sufficient soil moisture. During liner phase of development at time of sufficient soil moisture availability, enough assimilate might have produce and utilized by the plant during the growth and development stage and thus a excess diverted toward storage compound. But at later phase for greater assimilate demand of plant sink i.e. reproductive structure, more remobilization of storage compound.

But at later phase, for greater assimilate demand of plant sinks i.e. reproductive structures, more remobilization of storage compounds to active sites due to increased moisture in soil might have increased the yield significantly. The highly significant positive correlation existing between seed yield and yield attributes confirmed the above findings. These findings are in agreement with the results of Panda *et al.* (2004) [3].

Water use efficiency and oil content

The effect of irrigation on consumptive use of water increased significantly with increasing number of irrigation up to three (IR_5). Water use efficiency was highest at (IR_1) then after decrease the number of irrigation up to (IR_5). The increase in evapo-transpiration and infiltration losses due to more water application might be owing to increasing number of irrigation resulted into higher consumptive use probably the increase in seed yield was more as compared to amount of water used for total biomass production which might have increased water use efficiency under one irrigation at 30-35 DAS as compared two or three irrigation. Frequent irrigation through sometimes necessary for yield maximization; usually water the WUE because moist or wet surface of soil results in increased loss of soil moisture through evaporation but simultanesly increase consumptive use. These results are in close conformity with those of Das and Ray (2003) [1].

Irrigation had a significant effect on oil content. The application of irrigation stages IR_5 being at par with IR_3 levels. Significant enhanced oil content in seed over IR_0.

Table 1: Effect of irrigation schedules on plant height, number of leaves and number of primary of mustard

Treatment	Plant height (DAS)		Number of leaves (DAS)		Number of Primary branches (DAS)	
	40	100	40	Maturity	80	Maturity
IR_0	15.30	88.86	8.02	4.21	7.51	8.13
IR_1	16.35	94.13	8.60	5.08	7.86	8.35
IR_2	14.51	119.41	8.03	5.58	8.92	9.57
IR_3	17.39	122.71	9.63	6.23	9.96	10.68
IR_4	17.41	117.82	9.64	6.03	9.64	10.40
IR_5	17.43	134.45	9.65	6.46	10.35	11.09
S.Em	0.530	2.55	0.352	0.309	0.34	0.33
C.D.(P=0.05)	1.196	5.75	0.795	0.697	0.78	0.75

Table 2: Effect of irrigation schedules on seed yield, stover yield, biological yield and water use efficiency mustard

Treatment	Seed Yield	Stover Yield	Biological Yield	Weight of silique per plant (gm)
Irrigation Stage				
IR_0	9.58	25.13	34.73	49.26
IR_1	13.87	34.74	48.63	63.65
IR_2	14.59	36.01	50.60	63.73
IR_3	17.58	42.00	59.58	75.36
IR_4	17.09	41.65	58.74	74.46
IR_5	21.45	49.81	71.26	88.87
S.Em	0.71	1.12	1.36	1.30
C.D.(P=0.05)	1.61	2.53	3.08	2.91

Table 3: Effect of irrigation schedules on consumptive use of water, water use efficiency and oil content of mustard

Treatment	Consumptive use of water	Water use efficiency	Oil content (%)
Irrigation Stage		**Kg ha^{-1} mm**	
IR_0	11.56	10.43	38.0
IR_1	14.76	11.00	38.63
IR_2	16.56	10.01	39.26
IR_3	23.80	9.68	40.56
IR_4	23.16	9.60	40.66
IR_5	24.63	9.26	41.06
S.Em	0.44	0.285	0.13
C.D.(P=0.05)	0.98	0.634	0.30

References

1. Das LK, Ray MR. Response of different irrigation schedules on consumptive use, water use efficiency and crop coefficient value of mustard crop. Environment and Ecology. 2003; 21(1):143-145.
2. Lal B, Hossain MS, Alam MB, Ripon MA. Effect of irrigation and sowing method on yield and yield attributes of mustard. Rajshahi University journal of life & earth and agricultural sciences. 2013; 41:65-70.
3. Panda BB, Bandyopadhyay SK, Shivay YS. Effect of irrigation level, sowing dates and varieties on yield attributes, yield, consumptive water use and water use efficiency of Indian mustard. Journal of agril. Sci. 2004; 74(6):339-342.
4. Patel JR. Effect of irrigation and nitrogen on mustard. Journal Maharashtra Agril. Uni. 1999; 23:259-261.
5. Singh R, Singh SB, Faroda AS, Gupta SK. Effect of irrigation and nitrogen levels on quality and oil yield of Brassica. Indian Journal of Agronomy. 1994; 39:262-265.