

**EFFECT OF FOLIAR SPRAY OF BIOREGULATORS AND  
IRRIGATION ON DRY MATTER ACCUMULATION OF  
MUSTARD (*Brassica juncea* L.)**

A. SINGH<sup>1</sup> AND R. S. MEENA<sup>2</sup>

Rapeseed and mustard is generally, affect by irrigation water. The rapeseed-mustard is the crop that has fewer requirements of the water (Aujla *et al.*, 2005). To alleviate the harmful effect of drought stress, bioregulators may be used to change the different metabolic and physiological activities of the plant for increasing the yield of mustard crop (Meena *et al.*, 2013). Thiourea containing one SH group and it's is a sulphhydryl compound. The SH group has been implicated in photosynthetic translocation in plants (Giaquinta, 1976). It is simply concerned in light activation of photosynthetic enzymes (Salisbury and Ross, 1986). The exogenous application of Salicylic acid (SA) has been reduced the negative effect of water stress (Khan *et al.*, 2015) and spray of SA improve the growth of the plant (Hayat *et al.*, 2010). Glycinebetaine an important ammonium compound, it considered to be one of the most pre-dominant and effective osmoprotectants. The exogenous application of glycinebetaine improved the drought tolerance in plants (Mahmood *et al.*, 2009; Meena *et al.*, 2018). Hence, the study was conducted to see the effect of bioregulators on dry matter accumulation of Indian mustard under different levels of irrigation.

The experiment was conducted during the *rabi* (winter) seasons of 2014-15 and 2015-16 at Agricultural Research Farm, Department of Agronomy, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, India. The experimental field has clay loam soil. The soil have pH 7.58, 7.60, organic carbon 0.44%, 0.46%, available nitrogen 217.3, 224.1 kg/ha, available phosphorus 20.28, 22.85 kg/ha, available potassium 219.2, 226.4 kg/ha and available sulphur 20.90, 21.85 mg/kg/ha during both the years, respectively. The field experiment was laid out in split plot design, where, main plot treatment: three irrigation levels (zero irrigation, one irrigation (at pre-flowering stage) and two irrigation (at pre-flowering and pod formation stage) and Sub-plots treatment: seven foliar spray of bioregulators (control, thiourea@1000ppm, thiourea@ 500ppm, salicylic acid @ 100ppm, salicylic acid @ 50ppm, glycinebetaine@ 100ppm and glycinebetaine @ 50ppm) and irrigation was applied @ 6 cm by V-notch method. Foliar spray was done at 50 per cent flower initiation and 50 per cent pod formation stage. Furrows were opened at a spacing of 45 cm × 15 cm for the sowing of Indian mustard variety 'Ashirwad' with seed rate of 5kg/ha. The sowing was done on 13<sup>th</sup> November 2014 in 2014-15 and 23<sup>rd</sup>

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<sup>1&2</sup>Department of Agronomy, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi-221005 Uttar Pradesh, India.

November 2015 in 2015-16. The N, P, K and S were applied as 100, 50,50 and 40 kg/haby basal application. Nitrogen and phosphorus were applied through diammonium phosphate and urea, potash and sulphur through murate of potash and elemental sulphur, respectively. The ½ dose of N and full dose of P, K and S were applied at sowing and ½ dose of N given at the time of first irrigation as basal dressing but full dose of NPKS was applied at the time of sowing in zero irrigation treatment. The data were analyzed as per the standard procedure for “Analysis of Variance” (ANOVA) (Gomez and Gomez, 1976).

The pooled analysis showed that the Interaction effect of levels of irrigation and foliar spray of bioregulators were observed significant on dry matter accumulation (Table 1). The result indicated that the two irrigation was produce maximum dry matter accumulation (DMA) at 80, 100 DAS (days after sowing) and at harvest with the foliar spray of thiourea@1000ppm which was statistically at par with two irrigation with foliar spray of thiourea @ 500ppm. Therefore, the application of two irrigation with foliar spray of salicylic acid @ 100 ppm gave more dry matter than two irrigation with foliar spray of salicylic acid @ 50ppm. However, the application of two irrigation with foliar spray of glycinebetaine @ 100ppm was recorded higher dry matter over two irrigation with foliar spray of glycinebetaine @ 50ppm. The minimum dry matter accumulation at 80, 100 DAS and at harvest was recorded in zero irrigation + water spray, respectively. The maximum dry matter accumulation was recorded with the application of two irrigation (at pre flowering and pod formation stage). This might be due to the adequate soil moisture increase the availability of the nutrient in the soil for the plant to increase in growth parameters by cell elongation and cell division this ascribed due to higher activity of auxin in plant tissues and photosynthesis activity of plant so they produced more food (Mandal *et al.*, 2006; Meena *et al.*, 2019). The higher value of DMA was recorded with the foliar spray of thiourea @1000ppm which was found statistically at par with the application of thiourea @500 ppm. This may be ascribed due to the foliar application of thiourea motivating the photosynthetic carbon fixation mechanism that enhanced the canopy of the plant (Mehta and Sumeria; 2001, Meena *et al.*, 2020). Moreover, the favorable effect of foliar application of salicylic acid on dry matter accumulation might be due to increased photosynthetic efficiency by increased chlorophyll content, number of branches and leaf area index, which ultimately resulted in increased dry matter accumulation (Hassanein *et al.*, 2012; Meena *et al.*, 2017).

The significant improvement in Dry matter accumulation of Indian mustard could be achieved by application of two irrigation +foliar spray of thiourea @1000ppm followed by two irrigation + foliar application of thiourea @500ppm.

**Table 1. Interaction effect of foliar spray of bioregulators and irrigation levels on DMA (g/plant) at different days after sowing (DAS) of Indian mustard (pooled)**

Treatment	DMA (g/plant) at 80 DAS			DMA (g/plant) at 100 DAS			DMA (g/plant) at harvest		
	Zero irrigation	One irrigation	Two irrigation	Zero irrigation	One irrigation	Two irrigation	Zero irrigation	One irrigation	Two irrigation
Control (water spray)	23.83	31.41	33.00	25.32	34.31	36.20	26.86	36.23	37.79
Thiourea @ 500 ppm	33.72	38.36	39.76	37.05	42.56	44.22	39.03	44.81	46.72
Thiourea @ 1000 ppm	33.93	38.51	39.88	37.30	42.73	44.36	39.32	45.01	46.88
Salicylic acid @ 50 ppm	31.88	36.60	38.04	34.87	40.47	42.19	36.73	42.50	44.48
Salicylic acid @ 100 ppm	32.62	37.46	38.84	35.74	41.49	43.13	37.74	43.68	45.57
Glycinebetaine @ 50 ppm	29.97	34.79	35.88	32.60	38.33	39.62	34.67	40.03	41.52
Glycinebetaine @ 100 ppm	30.87	35.72	37.17	33.67	39.43	41.15	35.72	41.30	43.29
SEm±	0.16			0.20			0.24		
CD ( $p=0.05$ )	0.46			0.55			0.66		

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