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Effect of weed management practices on yield, nutrient content and nutrients uptake in Mustard (*Brassica juncea* (L.) Czern & Coss)

Navaneet Kumar, Raj Kumar Pathak, Ved Prakash, Chandra Shekhar and Abhishek Tiwari

Abstract
Field experiment was conducted during *rabi* 2017-18 and 2018-19 at Agronomy Resrearch Farm, A.N.D.U.A & T, Kumarganj, Ayodhya, to evaluate effect of various weed management practices on nutrient content and nutrient uptake of mustard (*Brassica juncea* (L.) Czern & Coss). The experiment was carried out with three replications in a Randomized Block Design (RBD) along with twelve treatments i.e., T_1-Pendimethalin (PE) @ 1000 g ha^{-1}; T_2-Isoproturon (POE) @ 1000 g ha^{-1} at 20 DAS; T_3-Pendimethalin (PE) @ 1000 g ha^{-1} + Hand weeding at 40DAS; T_4-Isoproturon (POE) @ 1000 g ha^{-1} + Hand weeding at 40 DAS; T_5-Pendimethalin (PE) @ 1000 g ha^{-1} + Paddy straw mulch @ 5 t ha^{-1} at 2-3DAS; T_6-Isoproturon (POE) @ 1000 g ha^{-1} + Paddy straw mulch @ 5 t ha^{-1} at 2-3DAS; T_7-Metribuzin (PE) @ 175 g ha^{-1}; T_8-Metribuzin (PE) @ 175 g ha^{-1} + Hand weeding at 40 DAS; T_9-Metribuzin (PE) @ 175 g ha^{-1} + Paddy straw mulch @ 5 t ha^{-1} at 2-3DAS; T_{10}-Paddy straw mulch @ 10 t ha^{-1} at 2-3DAS; T_{11}-Hand weeding at 20 and 40DAS and T_{12}-Weedy check respectively. The soil of the experiment at field was silty loam in texture and medium in soil fertility status. Two hand weeding (20 and 40 DAS) followed by T_{10} treatment (Paddy straw mulch applied @ 10 t ha^{-1} at 2-3 DAS)were found more effective in increasing the yield and yield attributes of mustard. While between the various weed management practices. Maximum nutrients content and uptake by crop was recorded under the two hand weeding (20 and 40 DAS) T_{11} treatment followed by paddy straw mulch @ 10 t ha^{-1} at 2-3 DAS during both the years of experimentation.

Keywords: Mustard, metribuzin, paddy straw, nutrient uptake and hand weeding

Introduction
Indian mustard [*Brassica juncea* (L.) Czern and Coss] occupies a prominent place being next in importance to soybean and groundnut, both in area and production. In India, it is cultivated on 6.23 m ha with 9.34 mt production and 1499 kg ha^{-1} productivity (Anonymous 2018-19) [1]. Indian mustard is predominantly cultivated in the states of Rajasthan, Haryana, Uttar Pradesh, Madhya Pradesh, Gujarat, Punjab and Bihar. Uttar Pradesh state contributed major part of 0.75 m ha with 1.12 mt production and 1483 kg ha^{-1} productivity. Thus, it has major share in area (12.08%) and production (11.96%) of mustard in our country. In order to bridge the gap between demand and supply, crop productivity need to be enhanced. Weed competition in mustard is more serious in early stage. Crop growth during winter season remains slow during the first 4-6 weeks after sowing. However, during later stage, it grows vigorously and has suppressing effect on weeds. As this crop is grown in poor soil with little management practices, weed infestation is one of the major causes of low productivity. At present, one hand weeding at 25 to 30 DAS is enough to control the weeds during early stage, but in view of scanty availability of laborers and ever increasing wages, the manual weed management has become costly and cumbersome. Selective herbicides proved effective as well as economic alternative to hand weeding and no residual (Yadav *et al*. 1997) [8]. Mulching enhances the water use efficiency and crop yield, besides decreasing the weed pressure. Mulching also improves soil condition and water holding capacity, which in turn affects crop growth and yield (Mondal *et al*. 2008) [4]. Mulches add soil organic matter, plant nutrients. Ceasing all these facts in view the present investigation was carried out to find out the effectiveness of various weed management practices on yield, nutrients content and uptake in mustard crop.

Materials and Methods

The field experiment was conducted during *rabi* 2017-18 and 2018-19 at Agronomy Research Farm, A.N.D.U.A & T, Kumarganj, Ayodhya. The experiment was carried out with three replications in a Randomized Block Design (RBD) along with twelve treatments i.e., T_1-Pendimethalin (PE) @ 1000 g ha^{-1}; T_2-Isoproturon (POE) @ 1000 g ha^{-1} at 20DAS; T_3-Pendimethalin (PE) @ 1000 g ha^{-1} + Hand weeding at 40DAS; T_4-Isoproturon (POE) @ 1000 g ha^{-1} + Hand weeding at 40DAS; T_5-Pendimethalin (PE) @ 1000 g ha^{-1} + Paddy straw mulch @ 5 t ha^{-1} at 2-3DAS; T_6-Isoproturon (POE) @ 1000 g ha^{-1} + Paddy straw mulch @ 5 t ha^{-1} at 2-3DAS; T_7-Metribuzin (PE) @ 175 g ha^{-1}; T_8-Metribuzin (PE) @ 175 g ha^{-1} + Hand weeding at 40DAS; T_9-Metribuzin (PE) @ 175 g ha^{-1} + Paddy straw mulch @ 5 t ha^{-1} at 2-3DAS; T_{10}-Paddy straw mulch @ 10 t ha^{-1} at 2-3DAS; T_{11}-Hand weeding at 20 and 40DAS and T_{12}-Weedy check respectively. The sowing of mustard was done on 05-11-2017 and 21-10-2018 using the variety NDR-8501 with seed rate of 5 kg ha^{-1}. The sowing of the crop was done at 45 cm apart keeping 15 cm plant to plant distance. The recommended dose of nutrients (80 kg N, 40 kg P_2O_5, 20 kg K_2O and 20 kg S ha^{-1}) was applied for better sowing of mustard. Herbicides were applied as PE (0-2 DAS) and POE (20 DAS) as per treatments. The soil of the experiment field was silty loam in texture and medium in fertility status with the pH value (8.20 and 8.17), EC (0.25 and 0.24) and organic carbon (0.33 and 0.34%). The available nitrogen, phosphorus, potassium and sulphur were (137.00 and 137.50 kg ha^{-1}), (15.35 and 14.90 kg ha^{-1}), (249.25 and 250.00 kg ha^{-1}) and (15.70 and 15.40) during 2017-18 and 2018-19. Straw yield was obtained by subtracting seed yield from total biomass yield. The Nutrient concentration in seed and straw yield were determined by standard method. The uptake/accumulation of nutrient in mustard seed and straw was calculated by multiplying the dry matter yield with their concentration. All the observation during individual years as well as in analysis was statistically analyzed for their test of significance using the *F*-test (Gomez and Gomez, 1984) [3]. The significant of difference between treatment means were compared with t critical difference at 5% level of probability.

Results and Discussion

Effect of yield, nutrients (N, P, K, and S) content and uptake by crop

The data in the Table-1 clearly indicated that weed management practices had significant effect on the seed and stover yield over control. Effect of two hand weeding (20 and 40 DAS) T_{11} treatments resulted into significantly the highest seed and stover yield (20.31 and 53.64 Kg ha^{-1}) and followed by paddy straw mulch @ 10 t ha^{-1} at 2-3 DAS (19.73 and 52.60) T_{10} treatment which were at par with T_9, T_5 and T_6 treatment over control of weedy check plot. The highest yield under two hand weeding was mainly due to adequate nutrients availability and less competition for moisture, nutrients and light to crop by weeds. (Tejashree *et al*. 2018 and Dhaliwal *et al*. 2019) [7, 2].

It is clear from the data pertaining to nitrogen content and uptake in seed and stover that two hand weeding (20 and 40 DAS) T_{11} treatments recorded significantly the highest N content in seed and stover (2.38 and 0.78%), P (1.14 and 0.60%), K (1.94 and 0.88%), S (0.87 and 0.48%). While highest uptake of N in seed and stover (48.34 and 41.84 Kg ha^{-1}), P (23.15 and 32.18 Kg ha^{-1}), K (39.40 and 47.20 Kg ha^{-1}) and S (17.67 and 25.75 Kg ha^{-1}) were also recorded with the same treatment T_{11} (Two hand weeding) and followed by paddy straw mulch @ 10 t ha^{-1} at 2-3 DAS. However, The lowest content and uptake of nutrients was recorded with weedy check plot during both the years. Under two hand weeding recoded mole was mainly due to effective herbicide and intercultural operation (Two hand weeding). They provide better environmental condition for operation of nutrients, herbicide, check the weed density and intercultural operation enhance the appearance of aeration and sunlight into soil. The increasing availability of nutrients means more translocation of nutrients (N, P, K, and S) from soil to plants. The overall the cumulative effect of improvement in their concentration in plant tissue. (Mukherjee, D. 2014 and Singh *et al*. 2020) [5 6].

Table 1: Effect of weed control on seed yield (kg ha^{-1}) and stover yield (kg ha^{-1}) in mustard (Pool data of two year 2017-18 and 2018-19)

Treatments	Seed yield (Kg ha^{-1})	Stover yield (Kg ha^{-1})
T_1-Pendimethalin (PE) @ 1000 g ha^{-1}	15.97	43.74
T_2-Isoproturon (POE) @ 1000 g ha^{-1} at 20DAS	14.72	40.54
T_3-Pendimethalin (PE) @ 1000 g ha^{-1} + Hand weeding at 40DAS	16.34	45.09
T_4-Isoproturon (POE) @ 1000 g ha^{-1} + Hand weeding at 40DAS	16.25	44.72
T_5-Pendimethalin (PE) @ 1000 g ha^{-1} + Paddy straw mulch @ 5 t ha^{-1} at 2-3DAS	18.15	49.04
T_6-Isoproturon (POE) @ 1000 g ha^{-1} + Paddy straw mulch @ 5 t ha^{-1} at 2-3DAS	18.08	48.08
T_7-Metribuzin (PE) @ 175 g ha^{-1}	16.22	44.59
T_8-Metribuzin (PE) @ 175 g ha^{-1} + Hand weeding at 40DAS	16.53	45.32
T_9-Metribuzin (PE) @ 175 g ha^{-1} + Paddy straw mulch @ 5 t ha^{-1} at 2-3DAS	18.56	50.03
T_{10}-Paddy straw mulch @ 10 t ha^{-1} at 2-3DAS	19.73	52.60
T_{11}-Hand weeding at 20 and 40DAS	20.31	53.64
T_{12}-Weedy check	13.03	36.07
SEM±	0.77	2.20
CD (P=0.05)	2.28	6.47

Note-
POE- Post-emergence
PE-Pre-emergence

Table 2: Effect of weed control on N, P, K and S concentration (%) and uptake in mustard (Pool data of two year 2017-18 and 2018-19)

Treatments	N content (%)		P content (%)		K content (%)		S content (%)	
	Seed	Stover	Seed	Stover	Seed	Stover	Seed	Stover
T_1-Pendimethalin (PE) @ 1000 g ha^{-1}	2.25	0.73	1.06	0.57	1.18	0.83	0.74	0.47
T_2-Isoproturon (POE) @ 1000 g ha^{-1} at 20DAS	2.24	0.72	1.06	0.57	1.80	0.82	0.72	0.45
T_3-Pendimethalin (PE) @ 1000 g ha^{-1} + Hand weeding at 40DAS	2.28	0.74	1.08	0.57	1.85	0.84	0.75	0.45
T_4-Isoproturon (POE) @ 1000 g ha^{-1} + Hand weeding at 40DAS	2.27	0.73	1.08	0.57	1.85	0.84	0.71	0.44
T_5-Pendimethalin (PE) @ 1000 g ha^{-1} + Paddy straw mulch @ 5 t ha^{-1} at 2-3DAS	2.32	0.75	1.10	0.59	1.89	0.85	0.80	0.47
T_6-Isoproturon (POE) @ 1000 g ha^{-1} + Paddy straw mulch @ 5 t ha^{-1} at 2-3DAS	2.30	0.74	1.10	0.58	1.89	0.85	0.73	0.45
T_7-Metribuzin (PE) @ 175 g ha^{-1}	2.26	0.71	1.07	0.56	1.83	0.85	0.71	0.45
T_8-Metribuzin (PE) @ 175 g ha^{-1} + Hand weeding at 40DAS	2.29	0.74	1.08	0.58	1.85	0.83	0.73	0.43
T_9-Metribuzin (PE) @ 175 g ha^{-1} + Paddy straw mulch @ 5 t ha^{-1} at 2-3DAS	2.33	0.75	1.10	0.58	1.89	0.84	0.81	0.46
T_{10}-Paddy straw mulch @ 10 t ha^{-1} at 2-3DAS	2.36	0.76	1.12	0.60	1.92	0.86	0.84	0.45
T_{11}-Hand weeding at 20 and 40DAS	2.38	0.78	1.14	0.60	1.94	0.88	0.87	0.48
T_{12}-Weedy check	2.22	0.70	1.05	0.56	1.80	0.77	0.66	0.35
SEM±	0.39	0.02	0.04	0.01	0.16	0.04	0.04	0.02
CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS

Table 3: Effect of weed control practices on N, P, K and S uptake of mustard (Pool data of two year 2017-18 and 2018-19)

Treatments	N uptake (Kg ha^{-1})		P uptake (Kg ha^{-1})		K uptake (Kg ha^{-1})		S uptake (Kg ha^{-1})	
	Seed	Stover	Seed	Stover	Seed	Stover	Seed	Stover
T_1-Pendimethalin (PE) @ 1000 g ha^{-1}	35.93	31.93	16.93	24.93	18.84	36.30	11.82	20.56
T_2-Isoproturon (POE) @ 1000 g ha^{-1} at 20DAS	32.97	29.19	15.60	23.11	26.50	33.24	10.60	18.24
T_3-Pendimethalin (PE) @ 1000 g ha^{-1} + Hand weeding at 40DAS	37.26	33.37	17.65	25.70	30.23	37.88	12.26	20.29
T_4-Isoproturon (POE) @ 1000 g ha^{-1} + Hand weeding at 40DAS	36.89	32.65	17.55	25.49	30.06	37.56	11.54	19.68
T_5-Pendimethalin (PE) @ 1000 g ha^{-1} + Paddy straw mulch @ 5 t ha^{-1} at 2-3DAS	42.11	36.78	19.97	28.93	34.30	41.68	14.52	23.05
T_6-Isoproturon (POE) @ 1000 g ha^{-1} + Paddy straw mulch @ 5 t ha^{-1} at 2-3DAS	41.58	35.58	19.89	27.89	34.17	40.87	13.20	21.64
T_7-Metribuzin (PE) @ 175 g ha^{-1}	36.70	31.66	17.38	24.97	29.72	37.90	11.53	20.07
T_8-Metribuzin (PE) @ 175 g ha^{-1} + Hand weeding at 40DAS	37.85	33.54	17.85	26.29	30.58	37.62	12.07	19.49
T_9-Metribuzin (PE) @ 175 g ha^{-1} + Paddy straw mulch @ 5 t ha^{-1} at 2-3DAS	43.24	37.52	20.42	29.02	35.08	42.03	15.03	23.01
T_{10}-Paddy straw mulch @ 10 t ha^{-1} at 2-3DAS	46.56	39.98	22.10	31.56	37.88	45.24	16.57	23.67
T_{11}-Hand weeding at 20 and 40DAS	48.34	41.84	23.15	32.18	39.40	47.20	17.57	25.75
T_{12}-Weedy check	28.93	25.25	13.68	20.20	23.45	27.77	8.60	12.62
SEM±	1.48	1.30	0.70	1.16	1.38	1.45	0.24	0.40
CD (P=0.05)	4.34	3.83	2.06	3.40	4.06	4.27	0.70	1.19

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