RESEARCH COMMUNICATION

EFFECT OF TILLAGE AND ORGANIC MULCHES ON CONTENT AND UPTAKE OF NUTRIENTS ON INDIAN MUSTARD IN VINDHYAN REGION OF EASTERN UTTAR PRADESH

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Abstract: A field experiment was conducted on conventional and reduced tillage with different organic mulches during 2012-13 to study the effect of tillage and organic mulches on content and uptake of nutrients on mustard crop in vindhyan region of eastern Uttar Pradesh at the Agronomy farm of Rajiv Gandhi South Campus, Barakachha (BHU), Mirzapur which is situated in *Vindhyan* region. Data revealed that the content and uptake in grain and stover of mustard crop increased significantly with implementation of reduced tillage and application of water hyacinth. The maximum content and uptake of N, P, K and S were found with application of water hyacinth @ 2 t per hectare under reduced tillage condition. Paddy straw mulch is the second highest treatment in content and uptake of macro nutrients in mustard crop. The increasing order of organic mulches was- No mulch < legume straw mulch < paddy straw mulch < water hyacinth regarding content and uptake of macro nutrients by mustard crop. The maximum content of nitrogen (3.40%) and (3.46%) among all nutrients was observed in mustard grain with application of water hyacinth under reduced tillage system. The similar trend was found in case of potassium uptake by stover of mustard crop (62.51 and 65.29 kg ha^{-1}) under reduced tillage and water hyacinth, respectively.

Keywords: Soil, Mulching, Mustard, Content, Uptake

INTRODUCTION

Mustard is an important *rabi* oilseed crop in India. It occupies about 24.70 per cent of area and 48.28 per cent of production of the total oilseed production in India. Its area, production and productivity in the country is 5.43 m ha, 6.41 million tonnes and 1159 kg ha^{-1}, respectively. In Rajasthan, the total area under mustard cultivation is 2.84 m ha with the estimated production of 3.5 m tonnes & average productivity of mustard in the state is 1234 kg ha^{-1} (Awasthi *et al*., 2009).

In general, mulches have favorable effect on physical, chemical and biological properties of soil by stabilizing soil, aggregates, enhancing soil organic matter, soil nutrients and reducing run off and soil erosion by intercepting rain drops. Soil moisture is the major limiting factor for crop production under rainfed situation, therefore, moisture conservation is important to achieve higher yield. The effect of mulch on soil temperature, moisture regime and root growth as well as yield depend on the climatic environment, made of mulch application and quality and quantity of mulch materials. Among the various soil moisture conservation practices, mulching is one of the technology is assuming greater importance. Further, mulching reduces evaporation, checking down weeds and there by enhance infiltration of water (Katiyar, 2001). Further it moderates wide fluctuation in soil temperature too. Green manuring also play an important role in soil and moisture conservation and improvement of soil properties. Mulching is the process of covering the surface soil with various mulching materials such as straw, dry leaves, stubbles, cut grasses, polyethylene etc. Tillage plays a vital role in plant growth at different stages under rainfed cultivation. It also improves soil condition by altering the mechanical impedance to root penetration, hydraulic conductivity and holding capacity, which in turn affects plant growth (Bonciarelli, 1986).

MATERIAL AND METHOD

A field study was carried out during rabi season of 2012-13 at Rajiv Gandhi South Campus, Brakachha (BHU), Mirzapur which is situated in *Vindhyan* region of district Mirzapur (25º 10’ latitude, 82º 37’ longitude and altitude of 427 meters above mean sea level) occupying over an area of more than 1000 ha. The climate of Barkachha is sub-humid, characterized by extremes of temperature both in summer and winter with medium rainfall. Maximum temperature in summer (May) is reached up to 39.85˚C and minimum temperature in winter (January) falls below 8.12˚C. The average annual rainfall of locality is 1100 mm, of which nearly 90 per cent is contributed by South West monsoon between July to September and 10 percent rain fall in other months. The total rainfall and evaporation during the crop season 2012-13 was 53.55 mm and 43.9 mm; maximum and minimum temperature was 37.48ºC and 4.75ºC, and relative humidity was 96.28 and 83.96 per cent respectively.

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The experiment was conducted with eight treatment combinations, involves application of Conventional tillage and no mulch (T_1M_0), Conventional tillage and Water hyacinth mulch (T_1M_1), Conventional tillage and paddy straw mulch (T_1M_2), Conventional tillage and legume straw mulch (T_1M_3), Reduce tillage and no mulch (T_2M_0), Reduce tillage and water hyacinth mulch (T_2M_1), Reduce tillage and paddy straw mulch (T_2M_2), Reduce tillage and legume straw mulch (T_2M_3). The experiment was conducted under two tillage systems viz., conventional tillage and reduces tillage. In this system seeds were sown in rows with the help of hand operated narrow blade (*Kudal*) by opening furrow, with spacing of 30 cm between two rows. Higher seed rate (5 kg ha^{-1}) was applied at 4 cm depth in open furrows made with a manual single row drill at a spacing of 30×10 cm and immediately covered with soil. The recommended dose of fertilizers (25:40:25:2 Kg NPK & S/ha). Fifty percent of nitrogen and full dose of phosphorus, potassium and sulphur were applied at sowing and remaining 50% N was applied at the pre - flowering stage. Nitrogen in grain and stover was determined by modified Kjeldahl method. Oven dried grain and stover samples were digested in diacid mixture and P, K and S were determined by adopting standard methods (Jackson, 1973).

RESULT AND DISCUSSION

The highest nitrogen content grain (3.40 per cent) and stover (0.79 per cent) were observed in reduced tillage over conventional tillage grain (3.29 per cent) and stover (0.73per cent). Among the different mulches, the water hyacinth mulch was higher in nitrogen content of grain and stover (3.46 and 0.80 per cent) compared to rest treatments. Similar findings was also reported by Quddus (1989) andVerma *et al.* (2011). Phosphorus content in grain (0.64 per cent) and stover (0.13 per cent) was found highest under reduced tillage over conventional tillage grain (0.60 per cent) and stover (0.11per cent). The similar trend was observed in case of water hyacinth mulch. Potassium content in grain (0.74 per cent) and stover (1.29 per cent) was found in reduced tillage over conventional tillage grain (0.70 per cent) and stover (1.24 per cent). In the reduced tillage system observed superior in case of sulphur content in grain (0.62 per cent) and stover (0.38 per cent) over conventional tillage grain (0.58 per cent) and stover (0.34 per cent) (Table 1). Similar trend was seen in all the treatment combinations of tillage and organic mulches, (Kumar and Lal, 2012). The data revealed that (Table 2) the uptake of N,P,K & S increased with increasing content of these nutrients under different treatments. In the tillage system nitrogen uptake by grain (46.76 kg ha^{-1}) and stover (38.38 kg ha^{-1}) were recorded highest in reduced tillage over conventional tillage grain (40.97 kg ha^{-1}) and stover (34.12 kg ha^{-1}). Maximum values of uptake of these nutrients by mustard grain and stover were recorded under water hyacinth with reduced tillage system, while minimum under no mulch treatment. Similar trend was found in case of phosphorus, potassium and sulphur uptake by mustard grain and stover (Cepeda and Gomez, 2010).

Table 1. Effect of tillage and organic mulches on content of N, P, K & S in grain and stover of mustard

Treatments	Nitrogen (%)		Phosphorus (%)		Potassium (%)		Sulphur (%)	
	Grain	Stover	Grain	Stover	Grain	Stover	Grain	Stover
Tillage								
Conventional tillage	3.29	0.73	0.6	0.11	0.7	1.24	0.58	0.34
Reduce tillage	3.4	0.79	0.64	0.13	0.74	1.29	0.62	0.38
CD (0.05)	0.03	0.01	0.01	0.02	0.02	0.03	0.04	0.03
Mulch								
No mulch	3.15	0.7	0.57	0.08	0.67	1.17	0.55	0.32
Water hyacinth mulch	3.46	0.8	0.65	0.14	0.75	1.31	0.64	0.39
Paddy straw mulch	3.42	0.78	0.63	0.13	0.74	1.3	0.62	0.38
Legume straw mulch	3.35	0.77	0.62	0.12	0.72	1.27	0.61	0.37
CD (0.05)	0.04	0.02	0.01	0.01	0.01	0.01	0.02	0.02

Table 2. Effect of tillage and organic mulches on uptake of N,P,K & S by grain and stover of mustard

Treatments	Nitrogen uptake (kg ha^{-1})		Phosphorus (kg ha^{-1})		Potassium uptake (kg ha^{-1})		Sulphur uptake (mg kg^{-1})	
	Grain	Stover	Grain	Stover	Grain	Stover	Grain	Stover
Tillage								
Conventional tillage	40.97	34.12	7.47	5.1	8.73	57.69	7.27	16.02
Reduce tillage	46.76	38.38	8.77	6.19	10.14	62.51	8.6	18.36
CD (0.05)	2.43	1.29	0.47	1.27	0.84	3.77	0.04	1.47
Mulch								
No mulch	36.31	30.42	6.58	3.64	7.7	51.15	6.33	13.76
Water hyacinth mulch	49.21	40	9.27	6.9	10.64	65.29	9.03	19.18
Paddy straw mulch	46.42	38.11	8.57	6.25	10.04	63.3	8.46	18.41
Legume straw mulch	43.51	36.47	8.06	5.81	9.36	60.67	7.91	17.4
CD (0.05)	2.31	1.11	0.5	0.7	0.49	1.31	0.46	0.75

CONCLUSION

Highest content of N, P, K and S by mustard grain and stover were recorded under water hyacinth with reduced tillage system, while minimum under no mulch treatment. Similar trend was found in case of phosphorus, potassium and sulphur uptake by mustard grain and stover.

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