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Short communication

Effect of mulching on microclimate, growth and yield of mustard (*Brassica juncea*) under mid-hill condition of Meghalaya

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Meghalaya, of North East India, falls under sub-tropical warm humid agroclimatic environment. It receives about 250 cm rainfall annually, of which about 65% is received during the four months of monsoon and 15% during two post monsoon months. The crop husbandry of Meghalaya is characterized by low cropping intensity (120%), mono cropping and subsistence farming. Little cultivation is possible during the winter months due to lack of sufficient rainfall and irrigation facilities. The region has an overall foodgrain deficiency of 8.3%, including the oilseed crops, (ICAR Vision Document 2030) as on 2012. It is apprehended that under increasing population pressure and climatic variability the foodgrain production scenario is likely to be affected adversely resulting in growing food insecurity. Soil moisture stress during *rabi* season is a great hindrance in increasing cropping intensity. Ameliorating *in situ* soil moisture stress using different mulches is a proven technology. Mulch can increase yield, water-use efficiency and profitability, while simultaneously decreases weed pressure. Through proper mulching, the problems of surface evaporation and soil moisture deficit in dry season can be solved to a great extent (Sarangi *et al*. 2010). Though affect of mulch on crop yield is known but how it improves the microclimatic conditions to obtain better yield needs to be studied, particularly in hilly rainfed condition.

To enhance oilseed production scenario in North Eastern region four cultivars of Indian mustard (*Brassica juncea*), *viz*., NPJ 112, NPJ 113, P 27 and P 28 (developed by IARI, New Delhi) were assessed for their performance under rainfed mid altitude condition (800-1400 m above msl) of Meghalaya during *rabi* season of 2013-14. Sowing was done on 30-10-2013, just 15 days after harvesting of *kharif* rice at the experimental farm of ICAR RC NEH Region, Umiam. The average soil moisture content on the day of sowing was 35% (%/volume). N, P_2O_5 and K_2O were applied @ 40:60:40 kg ha^{-1}, respectively. The crop germinated uniformly 5 DAS. After crop establishment, thinning and earthing up were done 21 DAS and a light irrigation was provided. Another light irrigation was given during the flowering stage (35-40 DAS). Two management treatments (mulch and no mulch) were introduced for conservation of *in situ* soil moisture by applying rice straw. The individual plot size was 16 m^2. The experiment aimed at evaluating the response of different mustard cultivars to residual soil moisture and effect of mulching on soil moisture conservation, plant growth, radiation interception (PAR) and economic yield. The cultivars attained physiological maturity after 105 - 117 DAS.

The results revealed that mustard respond well to residual soil moisture if this is planted immediately after harvesting of the main *kharif* crop. Umiam received last rainfall on 28th October 2013 and up to end of February 2014 not a single rainy day was recorded here. Hence, the crop entirely dependent on soil moisture, barring two light irrigations provided after earthing up and at flower initiation. The surface soil moisture (0-15 cm) got reduced over time but 8.8 to 30.7% high soil moisture was retained under straw mulch treatments at the flowering stage (Table 1). The higher soil moisture content below the mulches might be due to reduction in soil surface evaporation and weed intensity (Shirgure *et al*., 2003).

The effect of soil moisture was reflected on the growth of the crop as represented by high LAI values under mulch over no mulch condition. Better plant growth influences the radiation (PAR) interception pattern. PAR interception increased by 7.2 to 114.1% under mulch treatments. Two cultivars NPJ 113 and P 28 were found to have better LAI and PAR interception capacity over other

Table 1: Effect of mulching on surface soil moisture retention, radiation interception (PAR), LAI of different mustard cultivars at flower initiation stage (40 DAS) and seed yield.

Cultivar	No mulch	Mulch	Percent change (%)
	Soil moisture (%)		
NPJ 112	21.6	23.5	8.8
NPJ 113	20.8	27.1	30.7
P 27	22.5	24.5	8.6
P 28	19.7	23.5	19.5
	LAI		
NPJ 112	0.41	0.56	36.6
NPJ 113	0.68	0.81	19.1
P 27	0.40	0.51	27.5
P 28	0.80	0.82	2.5
	PAR interception (Wm^{-2})		
NPJ 112	81.4	87.3	7.2
NPJ 113	76.8	164.4	114.1
P 27	99.8	156.8	57.1
P 28	91.4	191.0	109.0
	Seed yield (kg ha^{-1})		
NPJ 112	3.8	5.7	50.0
NPJ 113	4.7	11.0	134.0
P 27	4.1	6.1	48.7
P 28	4.2	8.6	104.7

two cultivars and responded better to mulching treatments.

Better LAI and radiation interception positively affected the yield and yield attributes. Though no. of seeds per pod did not vary widely between mulch and no mulch treatments, no. of pods per plant increased to a great extent under mulched crops. This influenced the ultimate seed yield, which ranged between 5.7 (NPJ 112) and 11.0 (NPJ 113) q ha^{-1} under mulch treatment compared to 3.8 and 4.7 q ha^{-1} in no mulched crops. The average yield of these mustard cultivars ranged between 15 and 17 q ha^{-1} in their place of development and generally recommended for plains of Northern India. These cultivars are not yet reported for their performance evaluation in rainfed condition of North Eastern India, which is traditionally a rapeseed grown area. The experiment has revealed that if proper *in situ* soil moisture conservation is done mustard yield can be improved substantially. Modification of soil/ crop microclimate is positively related to increased harnessing of solar energy, improved plant growth and development and ultimate economic yield. Further, recycling of rice straw is contributing to soil carbon sequestration/mitigation of GHG emission in a place where straw burning is the common practice.

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