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Effect of non-chemical weed management practices on growth and yield of basmati rice

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Abstract
An experiment entitled, "Effect of non-chemical weed management practices in growth and yield of basmati rice" was conducted at the Organic Farming Research Centre, Chatha of SKUAST- J. during K*harif* season of 2019-2020. The soil of the experimental site was sandy clay loam in texture, The experiment consisted of 13 treatments *viz.*,T_1-Stale bed fb one hand weeding at 30 DAT, T_2-Wheel hoeing at 20 & 40 DAT, T_3-Rice straw mulch @ 2.5 t/ha, T_4-Rice straw mulch @ 5.0 t/ha, T_5-Azolla 1.0 t/ha,T_6-Mustard seed meal (MSM) @ 2.5 t/ha at 10 DBT,T_7-MSM @ 1.25 t/ha at puddling, T_8-MSM extract with MSM @ 0.4 t/ha at 5 DBT T_9-MSM extract with MSM @ 0.6 t/ha at 5 DBT T_{10}-MSM extract with MSM @ 0.8 t/ha at 5 DBT T_{11}-MSM extract with MSM @ 1.0 t/ha at 5 DBT T_{12}-Weed free,T_{13}-Weedy check. Stale bed fb one hand weeding at 30 DAT and Wheel hoeing at 20 & 40 DAT resulted in significant increased of growth parameters *viz.* plant height, dry matter accumulation and leaf area index at 60, 90 and at harvest and also found lowest weed dry matter. Among the different non chemical weed management practices, stale bed fb one hand weeding at 30 DAT gave higher grain yield (3047 kg//ha) and followed by Wheel hoeing at 20 & 40 DAT (2958 kg/ha).

Keywords: mustard seed meal (MSM), DAT- days after transplanting, stale bed

Introduction
Rice (Oryza sativa L.) stands first amongst all the food grain crops of the world and is the staple food of more than half of the world's population. The total area under rice cultivation in the world is 162.06 million hectares with a production and productivity of 496.40 million tonnes and 30.63 quintal hectare, respectively In India, rice is cultivated around the year in diverse agro-ecologies spreading over 43.77 million hectares with a production of 112.76 million tonnes and productivity of 25.76 quintals per hectare (Anonymous, 2019) [4]. In the Union Territory of Jammu and Kashmir, the total area under rice cultivation is 262.01 thousand hectares with a production of 6161 thousand quintals and average productivity of 23.51 quintal hectares. In the Jammu region of Jammu and Kashmir, the total land under rice is 131.53 thousand hectares with production and productivity of 2839 thousand quintals and 21.58 quintals per hectare, respectively (Anonymous, 2018-19) [2, 3, 4]. The R.S. Pura region of these subtropical lower lands is world famous for the best quality aromatic rice having great export potential which is an important asset for Jammu and Kashmir in particular.

The farmers also started to grow basmati rice under organic farming but facing lot of challenges of organic pest control with which weed control is a bigger challenge in particular. Weeds are often recognized as the most serious threat to organic crop production and fear of ineffective weed control is often perceived by farmers as one of the major obstacles to conversion from conventional to organic farming. Under the guiding principles of organic agriculture, farmers cannot use chemical herbicides and have to keep the weed below thresh hold value. Weeds by the virtue of their high adaptability and faster growth dominate the crop habitat and compete for various growth resources *viz*; nutrients, water, light, space and even CO2 and reduce the yield 35-55 per cent in transplanted rice (Gautam and Mishra, 1995) [8]. Weed management in transplanted rice in organic farming through non-chemical approaches may be the best-suited option for farmers. This can be achieved by removing weeds manually, mechanical, mulching, stale bed technique, and application of Azolla and mustard seed meal through allelopathic bio-product of the plants. Mechanical or physical methods are being employed ever since man began to grow the crop. They include hand hoeing, hand pulling, tillage, digging, sickling, burning, flooding and mulching. Hand hoeing is a post-planting intercultural operation, which stirs the soil and makes it loosened. It is effective against annual weeds but not against perennial weeds, it cannot control the under-ground vegetative structures of perennial weeds. Mulching has enough bearing towards weed suppuration in cropped and non-cropped situations. The lack of sunlight inhibits the photosynthesis of germinating weed. It is commonly believed that Azolla suppresses the growth of certain aquatic weeds. Weed growth is suppressing ones Azolla from a thick, light-proof mat. There are meanly two mechanisms for this suppuration; the most effective mechanism is the light starvation of young weed seedlings by the blockage of sunlight and the other is the physical resistance to weed seedlings exposed in a heavy interlocking Azolla mat. In the case of weed-infested rice field, the benefit from Azolla weed suppuration may even surpass its benefits as a nitrogen source. Rice seedling is not affected by azolla's weed suppuration effect because when transplanted, they stand above the Azolla mat (Lakshmi *et al*., 2019) [10]. The use of herbicides is difficulty in assuring crop safety the use of products derived from natural sources to control pests is appealing and developing new uses for mustard seed meal and other by-products of the expanding bio-fuel industry may increase the profitability of bio-fuel production (Boydston *et al*., 2008) [9]. Applied as a surface mulch or soil amendment the mustard seed meal is a by-product of mustard seed extract to control weeds. Mustard seed meal (MSM) contains glucosinolates that typically undergo enzymatic hydrolysis

to isothiocyanates, SCN2, nitriles, and other compounds when added or sprayed to moist soil can suppress seedling emergence of several common weeds (Swati *et al*., 2015) [11].

Materials and methods

The present investigation entitled "Effect of non-chemical weed management practices in growth parameter of basmati rice" was carried out at the Research Farm of Centre of Organic Farming, Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu, the soil of the experimental site was sandy clay loam in texture, located at an altitude of 32^0-40′ N and a longitude of 74^0-58′ E with an altitude of 332 m above mean sea level. The experiment was laid out in randomized block design (RBD) with thirteen treatment combinations and three replications. *viz*.,T_1-Stale bed fb one hand weeding at 30 DAT,T_2-Wheel hoeing at 20 & 40 DAT,T_3-Rice straw mulch @ 2.5 t/ha,T_4-Rice straw mulch @ 5.0 t/ha, T_5-Azolla 1.0 t/ha,T_6-Mustard seed meal (MSM) @ 2.5 t/ha at 10 DBT,T_7-MSM @ 1.25 t/ha at puddling,T_8-MSM extract with MSM @ 0.4 t/ha at 5 DBT T_9-MSM extract with MSM @ 0.6 t/ha at 5 DBT T_{10}-MSM extract with MSM @ 0.8 t/ha at 5 DBT T_{11}-MSM extract with MSM @ 1.0 t/ha at 5 DBT T_{12}-Weed free, T_{13}-Weedy check. All treatments as per technical programme were applied in the field. The verity B-370 was transplanted in the second week of the July.

Result and discussion

Plant height is a reliable index of growth and development representing the infrastructure build-up over some time. Periodic plant height (cm.) recorded at 30, 60, 90, DAT and harvest is presented in Table 1.

Table 1: Effect of non-chemical weed management practices on plant height (cm) in rice

Treatment		Plant height (cm)			
		30 DAT	**60 DAT**	**90 DAT**	**At harvest**
		2019	2019	2019	2019
T_1	Stale bed fb one hand weeding at 30 DAT	42.82	75.26	110.14	149.40
T_2	Wheel hoeing at 20 & 40 DAT	40.95	73.86	109.71	142.65
T_3	Rice straw mulch @ 2.5 t/ha	39.82	64.80	95.87	130.19
T_4	Rice straw mulch @ 5.0 t/ha	38.55	65.79	97.58	133.23
T_5	Azolla 1.0 t/ha	28.68	63.91	96.86	129.61
T_6	Mustard seed meal (MSM) @ 2.5 t/ha at 10 DBT	35.91	65.47	97.23	132.43
T_7	MSM @ 1.25 t/ha at puddling	35.35	65.17	96.47	131.19
T_8	MSM extract with MSM @ 0.4 t/ha at 5 DBT	28.46	58.97	92.97	120.00
T_9	MSM extract with MSM @ 0.6 t/ha at 5 DBT	29.67	59.24	94.42	125.74
T_{10}	MSM extract with MSM @ 0.8 t/ha at 5 DBT	30.05	61.59	94.82	127.95
T_{11}	MSM extract with MSM @ 1.0 t/ha at 5 DBT	29.71	62.89	95.05	128.46
T_{12}	Weed free	43.29	76.35	111.44	150.40
T_{13}	Weedy check	19.33	53.66	89.02	90.55
Sem (±)		2.14	2.70	3.73	4.46
CD (0.5%)		NS	7.90	10.90	13.04

Data showed that plant height increased with the advancement in crop age and this increase was rapid during the early crop growth period with a conspicuous increase between 60 and 90 DAT and thereafter, a slow rate of decrease in plant height was observed at harvest. Plant height at 30 DAT was found non-significant. The significantly higher plant height was recorded in treatment T-$_{12}$ weed free which was at par with stale bed fb one hand weeding at 30 DAT and T_2 -Wheel hoeing at 20 & 40 DAT at 60, 90 DAT and at harvest. However, the lower plant height was recorded in the treatment T_{13}-Weedy check. Plant dry matter accumulation is an important index indicating the photosynthetic efficiency of the crop which ultimately influences the crop yield as presented in Table 2.

Table 2: Effect of non-chemical weed management practices on plant dry matter accumulation (g/m^2) in rice

Treatment		Plant dry matter accumulation (g/m^2)			
		30 DAT	**60 DAT**	**90 DAT**	**At harvest**
		2019	2019	2019	2019
T_1	Stale bed fb one hand weeding at 30 DAT	60.34	175.88	373.42	478.42
T_2	Wheel hoeing at 20 & 40 DAT	57.00	174.52	365.46	471.11
T_3	Rice straw mulch @ 2.5 t/ha	54.19	146.21	316.25	379.81
T_4	Rice straw mulch @ 5.0 t/ha	52.83	149.14	318.19	402.84
T_5	Azolla 1.0 t/ha	48.96	143.61	313.67	376.23
T_6	Mustard seed meal (MSM) @ 2.5 t/ha at 10 DBT	57.49	148.61	319.59	398.48
T_7	MSM @ 1.25 t/ha at puddling	54.62	147.61	317.85	381.19
T_8	MSM extract with MSM @ 0.4 t/ha at 5 DBT	48.59	122.58	309.87	292.38
T_9	MSM extract with MSM @ 0.6 t/ha at 5 DBT	49.30	130.22	310.54	338.11
T_{10}	MSM extract with MSM @ 0.8 t/ha at 5 DBT	50.82	139.44	311.56	340.85
T_{11}	MSM extract with MSM @ 1.0 t/ha at 5 DBT	52.26	140.34	312.94	354.40
T_{12}	Weed free	61.21	176.40	394.63	486.04
T_{13}	Weedy check	49.94	121.33	209.38	260.51
Sem (±)		4.30	8.29	16.66	24.15
CD (0.5%)		NS	24.21	48.63	70.50

Plant dry matter accumulation (g/m^2**)** at 30 DAT was found non-significant where as the higher dry matter accumulation was recorded in treatment weed-free which was found at par stale bed fb one hand weeding at 30 DAT and T_2-Wheel hoeing at 20 & 40 DAT at 60, 90, DAT and harvest. The lowest dry matter accumulation was observed in treatment T_{13}-weedy check. The crop data at 30, 60, and 90 DAT and at harvest on leaf area index are presented in Table 3.

Table 3: Effect of non-chemical weed management practices on leaf area index of in rice

Treatment		Leaf area index			
		30 DAT	**60 DAT**	**90 DAT**	**At harvest**
T_1	Stale bed fb one hand weeding at 30 DAT	0.76	2.40	3.59	2.17
T_2	Wheel hoeing at 20 & 40 DAT	0.73	2.36	3.58	2.13
T_3	Rice straw mulch @ 2.5 t/ha	0.68	2.17	3.33	1.94
T_4	Rice straw mulch @ 5.0 t/ha	0.72	2.31	3.50	2.08
T_5	Azolla 1.0 t/ha	0.60	2.16	3.32	1.93
T_6	Mustard seed meal (MSM) @ 2.5 t/ha at 10 DBT	0.70	2.25	3.48	2.02
T_7	MSM @ 1.25 t/ha at puddling	0.69	2.24	3.41	2.01
T_8	MSM extract with MSM @ 0.4 t/ha at 5 DBT	0.37	2.05	2.27	1.82
T_9	MSM extract with MSM @ 0.6 t/ha at 5 DBT	0.46	2.11	3.17	1.88
T_{10}	MSM extract with MSM @ 0.8 t/ha at 5 DBT	0.50	2.10	3.23	1.87
T_{11}	MSM extract with MSM @ 1.0 t/ha at 5 DBT	0.56	2.14	3.30	1.91
T_{12}	Weed free	0.79	2.93	3.60	2.70
T_{13}	Weedy check	0.22	1.93	3.09	1.70
SEm (±)		0.12	0.11	0.15	0.10
CD (0.5%)		NS	0.30	0.44	0.30

At 30 DAT, different non-chemical weed management treatments failed to show any significant impact on the leaf area index. At 60, 90 DAT and harvest, highest leaf area index of rice was recorded in weed free (T_{12}) which statistically at par with (T_1)-stale bed fb one hand weeding at 30 DAT and (T_2)-wheel hoeing at 20 & 40 DAT. The lower leaf area index was observed in weedy check at 60, 90 DAT and harvest. The impact of various non chemical weed management treatments on the weed dry matter (g/m^2**)** and grain yield of basmati rice is presented in Table 4.

Table 4: Effect of non-chemical weed management practices on total weed dry matter (g/m^2) and grain yield in rice

Treatment		Total weed dry matter (g/m^2) at harvest	Grain yield (kg/ha)
T_1	Stale bed fb one hand weeding at 30 DAT	9.71 (93.47)	3047
T_2	Wheel hoeing at 20 & 40 DAT	9.64 (91.85)	2958
T_3	Rice straw mulch @ 2.5 t/ha	11.39 (128.78)	2605
T_4	Rice straw mulch @ 5.0 t/ha	10.51 (109.41)	2644
T_5	Azolla 1.0 t/ha	11.58 (133.03)	2573
T_6	Mustard seed meal (MSM) @ 2.5 t/ha at 10 DBT	10.66 (112.76)	2633
T_7	MSM @ 1.25 t/ha at puddling	10.86 (116.91)	2611
T_8	MSM extract with MSM @ 0.4 t/ha at 5 DBT	13.45 (179.99)	2353
T_9	MSM extract with MSM @ 0.6 t/ha at 5 DBT	12.82 (163.38)	2462
T_{10}	MSM extract with MSM @ 0.8 t/ha at 5 DBT	12.48 (154.82)	2476
T_{11}	MSM extract with MSM @ 1.0 t/ha at 5 DBT	12.06 (144.56)	2492
T_{12}	Weed free	1.00 (0.00)	3150
T_{13}	Weedy check	13.69 (186.59)	2007
Sem (±)		0.44	105
CD (0.5%)		1.30	308

The data was subjected to √x+1 transformation; Figures in the parenthesis are original values

The higher weed dry matter (g/m^2) was recorded in weedy check at harvest. Among the various non chemical weed management treatments, (T_1)-stale bed fb one hand weeding at 30 DAT gave lower weed dry matter followed by (T_2)-wheel hoeing at 20 & 40 DAT. It is apparent from the data that weed-free treatment recorded a maximum grain yield (3150 kg/ha) whereas weedy check recorded minimum grain yield (2007 kg/ha). Among the various non chemical weed management treatments, (T_1)-stale bed fb one hand weeding at 30 DAT gave higher grain yield (3047 kg/ha) which was statistically at par with (T_2)-wheel hoeing at 20 & 40 DAT.

Among the different non-chemical weed management treatments, stale bed fb one-hand weeding at 30 DAT and Wheel hoeing at 20 & 40 DAT found better than other treatments. This is due to the reason that reduction in weed growth at critical crop growth stages by the stale bed and hand weeding and Wheel hoeing at 20 & 40 DAT resulted in good aeration and more nutrient availability to crop growth. It might be due to overall favourable growth and more photosynthesis. Similar results were reported by Sharma (2018) and (Arif *et al.* 2004).

Conclusion

Stale bed fb one hand weeding at 30 DAT (T_1) and Wheel hoeing at 20 & 40 DAT (T_2) resulted lower weed dry matter and higher growth parameters *viz.* plant height, dry matter accumulation, leaf area index and grain yield. It may be concluded that among the different non-chemical weed management treatments, stale bed fb one hand weeding at 30 DAT or wheel hoeing at 20 & 40 DAT were found effective for control of weeds in basmati rice.

References

1. Ahmad M, Hani NM, Nirmal NP, Fazial FF, Mohtar NF, Romli SR. Optical and thermo-mechanical properties of composite films based on fish gelatin/rice flour fabricated by casting technique. Progress in Organic Coatings,2015:84:115-127.
2. Anonymous. Fertilizer consumption in India and Jammu and Kashmir. Indian Fertilizer Scenario. Ministry of chemicals and fertilizers, New Delhi, India, 2018, 71-72.
3. Anonymous. Agricultural Statistics at a Glance, Directorate of economics and statistics, Department of Agriculture, Cooperation and Farmers welfare, Ministry of Agriculture, Govt. of India, New Delhi, 2018-19, 88.
4. Anonymous, Economic survey, Directorate of Economics and Statistics. Govt. of Jammu and Kashmir, 2019, 190-194.
5. Anonymous. Economic survey, Directorate of Economics and Statistics. Govt. of Jammu and Kashmir, 2021,118-121.
6. Sharma A. Effect of organic sources on nutrients and weed management on productivity and profitability of basmati rice based cropping system. Ph.D thesis, SKUAST-Jammu, 2017, 118 -122.
7. Raza Ejaz, Khalid Mahmood Chaudhary, Umair Talib, Inayatullah. Effectiveness of various chemical and non-chemical weed management practices as perceived by the farmers under cotton wheat cropping system in the Punjab. Int J Res Agron 2019;2(1):23-27. DOI: 10.33545/2618060X.2019.v2.i1a.14
8. Gautam KC, Mishra JS. Problems, prospects and new approaches in weed management. Indian Journal of Weed Science,1995:21:7-19.
9. Boydston R. Mustard seed meal suppresses weeds in potato and peppermint. Western Society of Weed Science Meeting Proceeding,2008:61:37.
10. Lakshmi RKS, Seshiah CV, Reddy PR, Nagaraja K, Kumar I. Influence of Incorporation of Azolla Meal on Performance of Laying Japanese Quails. Journal of Animal & Plant Sciences,2019:36(1):47-50.
11. Swati Sehwag S, Das M. A brief overview: Present status on utilization of mustard oil and cake. Indian Journal of Traditional Knowledge,2015:14(2):247.
12. Yoshihashi T, Huong NTT, Surojanametakul V, Tungtrakul P, Varanyanond W. Effect of Storage Conditions on 2–Acetyl-1–pyrroline content in aromatic rice variety, khao dawk mali 105. Journal of Food Science,2005:70(1):S34-S37.