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Effect of agronomic techniques on lentil seed production

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Abstract

The varying mode of different farmers' cultivation techniques reformed the qualitative and quantitative attributes related to yield of two cultivars/genotypes (V1 and V2). In field factors, the treatment T7 (Zero Tillage, Mulching, Irrigated) showed upper value in most of the characters emphasizing the topmost effect by lowering the seed moisture content, an vital qualitative parameter at harvest. The prospect of T3 (Conventional Tillage, Higher NPK, Irrigated) was also noticeable in other cases like thousand seed weight that deal with decisive target, seed yield. In a few cases like weight of seed-pod ratio, plant population etc., T10, T5 and T6 individually showed topmost peak for specific character. Considering all field based yield linking parameters, the specific mulching effect showed a positive response for irrigated (T7) and rainfed situation (T10), though presence of fertilizer (T3) highlighted a positive role to fulfil the quantitative approach. The variation in variety continued the top effect on V1 only in incidence of maximum response of T3 where V2 frequently in occurrence of T7. The same trend was observed in interaction of that specific genotype-treatment combination of that specific character.

Keywords: Zero Tillage, Conventional Tillage, Mulching, Irrigation and fertilizer

Introduction

There are several evidences of remarkable increase in the seed yield of crops in the rainfed cropping system through the maintenance of appropriate vegetative cover under no-till circumstance (Dhyani *et al.*, 2009) [4]. Mulching of crop field by *Leucaenaleucocephala*helps in conserving soil moisture forproper growth and improvement of crops (Sharma *et al.*, 2010) [16]. The use of vegetative cover under zero-tillage situation helps to increase root growth by creating favourable soil environment and decreasing weed infestation. This situation is ideal for better plant growth and higher yield of winter crops (Singh *et al.*, 1998) [17]. This discussion suggests that the adoption of resource conserving technologies, such as zero-tillage and residue management is essential in rainfed condition to improve productivity, resource-use efficiency and sustainability of low input agriculture. Therefore, the aim in this research is to understand the effects of preceding crops and residue management in Rice under zero-till semi-arid condition.

Types of reduced tillage, together with nitrogen fertilizer application, not only allow optimal use of water and plant nutrients found in the soils but also increase seed yield substantially (Milton, A.S. *et al.*, 1998) [13]. Farming systems involving zero tillage, or reduced levels of tillage, rotatating crops, and large-scale returning of crop residues to the soil can increase the produced biomass and diversity of soil micro flora activities compared to the customary cultural practices (Govaerts, B *et al*., 2007) [5]. Tillage increases rooting through improving soil physical conditions, but this improvement is potential if there are no hardpans deep in the soil Line, B. *et al.* (1993) [9]. Plant residue management is one of the farming strategies employed in sustainable agriculture qualitative seed production. With a rise in the yield of lentils seed, the total plant residue increases as well. This can lead to an improvement in soil organic matter content (Marten, D., 2000) [12]. Nitrogen increases the level of biomass production and redistributes the photosynthetic, and thus causes more seeds to be produced and filled better after flowering (Shanggan, Z.P. *et al.*, 2000) [15]. Correct application of nitrogen fertilizers, together with the use of plant residue, may increase yield. Plant residues on the soil surface can decrease water evaporation, crusting, and the formation of a skin of fine material on the immediate surface of the soil as well; and thus improve soil in filterability and reduce soil erosion (Mahpatra, B.S., 1991) [11]. Plant residues can decrease the effects of climate changes through soil organic carbon sequestration and compensation of carbon dioxide and other greenhouse gases emission (Wilhelm, W. *et al.,* 2004) [18]. The main purpose of this research was to study the effects of various methods of tillage, the effects of nitrogen fertilizer application, different type rice straw residue and their mutual effects on the quantitative and qualitative seed production in lentils.

Material and Methods

The field trial was conducted in 'AB -Seed farm' under BCKV, Nadia, West Bengal considering the years 2013-14 and 2014-15 with a medium well drained sandy-loam soil containing land in an elevation of 9.75 m above MSL.The variable techniques of field trial on crop lentil cv. V1 (B77)and V2 (WBL58) were executed as treatments to consider the seed production viz. CT (conventional tillage) + recommended NPK (20:40:20 kg/ha) + IR (Irrigated) as T1; CT + low NPK (15:40:20 kg/ha) + IR as T2; CT + high NPK (25:40:20 kg/ha) + IR as T3; CT + recommended NPK + RF (Rainfed) as T4; ZT (zero tillage) with 10 cm rice straw + recommended NPK + IR as T5; ZT with 20 cm rice straw + recommended NPK + IR as T6; ZT with rice straw mulching + recommended NPK + IR as T7; ZT with 10 cm rice straw + recommended NPK + RF as T8; ZT with 20 cm rice straw + recommended NPK + RF as T9; ZT with rice straw mulching + recommended NPK + RF as T10. The average value of two years experiment was considered to minimize the experimental result in a comprehensive mode.Random Block Design (RBD) was utilized for statistical analysis of facts associated to these activities. The outcomes were achieved at 5% level of significant by using the computer software system, OPSTAT.

Results

The two common cultivars V1 (B77) and V2 (WBL58) of lentils were grown under approaching of 10 different agronomic techniques (T1 to T10) highlighting variable sources of water (irrigated and rainfed), variable nutrient status (NPK), soil management practices (different tillage operations) and various residues of previous crop (rice crops). The interpretations were restricted to facilitate seed productivity on field aspect considering the average value of two years observations in field. The treatments showed the diverse cultivation techniques on variable plant population representing a significant distance under few cases where T5 **(**ZT, 10 cm straw, Com NPK, IR.) and T6 **(**ZT, 20 cm straw, Com. NPK, IR.) pointed to the highest insignificant value, but they were significant to others. T3 also showed a good value and T8 **(**ZT, 10 cm straw, Com. NPK, NIR.) highlighted the lowest value among all. The varietal difference also indicated a considerable demarcation on overall mean values of two years in which V2 (WBL 58) was top over V1 (B77). The interacted values allowing for both treatment-varieties indicated the topmost value in T6V2 where T5V2 was the next. In these values, insignificant demarcation was prominent (Govaerts, B. *et al*., 2007, Sharma *et al.,* 2010) [5, 16]. The number of pod of the particular pant indicated an insignificant result only in T1 (CT, Com. NPK, IR.) and T2 (CT, Lower NPK, IR.) considering the lowest in T5 (ZT, 10 cm straw, Com NPK, IR.). The cultivation treatment T7 (ZT, Mulching, Com. NPK, IR.) specified the highest significant value followed by T10 (ZT, Mulching, Com. NPK, NIR.) and T3 (CT, Higher NPK, IR.).The significant variation was also observed in overall varietal mean in which maximum reactive value was observed in V2 (WBL 58). The significant interaction was also common in individual interaction of treatment-variety. The highest observable result was highlighted in T7V1 followed by T7V2 in a significant manner (Singh *et al.,* 1998, Sharma *et al.,* 2010) [17, 16]. The moisture content of seed at harvesting stage signified the differential result among different treatments. The lowest significant result was observed in T7 (ZT, Mulching, Com. NPK, IR.) favorable to maintain the seed quality. T3 (CT, Higher NPK, IR.), T2 (CT, Lower NPK, IR.), and T9 (ZT, 20 cm straw, Com. NPK, NIR.) indicated highest moisture in an insignificant pattern describing for deterioration of seed quality. The mean varietal difference was also observed in a significant model where V2 (WBL 58) showed the best effect. The interaction effect of treatment-variety interactions highlighted the best effect in T7V2followed by T8V1 (ZT, 10 cm straw, Com. NPK, NIR.B77) close to T7V1. Most of the interacted values showed a significant variation with each other (Govaerts, B. *et al*., 2007) [5]. The ratio of seed weight and pod weight designated the sharing pattern from source to sink constructive for quality production. The higher value indicated the proper assimilation of created products at time of photosynthesis. The treatments T3 (CT, Higher NPK, IR.) and T5 (ZT, 10 cm straw, Com NPK, IR.) indicated the highest value significant to others. The treatment values of T2 (CT, Lower NPK, IR.), T7 (ZT, Mulching, Com. NPK, IR.), T8 (ZT, 10 cm straw, Com. NPK, NIR.), and T9 (ZT, 20 cm straw, Com. NPK, NIR.) constructed an insignificant group that was significant to another insignificant group of T1 (CT, Com. NPK, IR.) and T6 (ZT, 20 cm straw, Com. NPK, IR.).The overall mean varietal difference was also prominent indicating a significant higher value in V1 ((B77). The interaction effects of treatment-variety showed a significant demarcation in most of the cases though in some cases it was very prominent highlighting its outstanding result in T3V2 (CT, Higher NPK, IR., WBL 58) (Singh *et al.,* 1998) [17]. 1000-seed weight (g), the treatment effect maintained a significant pattern among the different treatments for this parameter. The highest significant value was observed in T3 (CT, Higher NPK, IR.) that was closely associated with T7 (ZT, Mulching, Com. NPK, IR.) only. T5 (ZT, 10 cm straw, Com NPK, IR.) and T8 (ZT, 10 cm straw, Com. NPK, NIR.) indicated the lowest performance in a significant deviation considering all treatments. The values linked to mean varietal effect showed a significant prominence in V1 (B77). The interaction effects of treatment-variety evaluated a considerable significant value in most of the cases where maximum effect was observed in T7V1 followed by T3V1 in an insignificant pattern within them. The considering the important character seed yield/plant in the different treatments of cultivation pattern indicated the significant variation in almost all cases where the maximum value were observed in T7 (ZT, Mulching, Com. NPK, IR) and T10 (ZT, Mulching, Com. NPK, NIR) highlighting an insignificant variation within them. The values of varietal effect were also observed in a significant manner maintaining the highest value in V2 (WBL 58).The unlike individual interaction of treatment-genotypes indicated the extensive variation for all values in the same way as before. T7V1 (ZT, Mulching, Com. NPK, IR, B77) specified the uppermost interaction effect though it was insignificant to T10V2 only (Singh *et al.,* 1998) [17]. Table, the ultimate quality seedling parameter was seed yield of a particular plot (square meter) in which T3 (CT, Higher NPK, IR.) was the best treatment among different cultivation pattern in a significant demarcation. T7 (ZT, Mulching, Com. NPK, IR.), T10 **(**ZT, Mulching, Com. NPK, NIR) and T4

(CT, Com. NPK, NIR.) indicated second best value considering an insignificant relationship within them but significant to others. V1 (B77) showed the highest significant value over V2 (WBL 58) and it was observed in most of the cases of different treatments. In interaction treatment-genotypes, the significant prominent variation was observed in most cases. The most prominence was observed in T3V1 in a high significant demarcation among diverse treatments (Govaerts, B. *et al*., 2007) [5].

The diverse mode of farming can adjust or preserve the seed superiority to some degree in both pre and post-harvest stage. Considering the consequence of different Agronomic treatments, the effect of mulching under zero tillage was significant value in terms of quantity and mainting seed quality that can be supported by the findings of (Caesar-Ton that *et al.* 2001) [2]; (Wright and Upadhyaya, 1998) [19]. They observed the increasing concentrations of glomal in (IREEG) and soil aggregating basidiomycete fungi on the top soil surface (0-5 cm) under zero tillage system helpful to maintain plant health and soil health also. Zero till method enhances the decay of crop residues chiefly in association with the water, and for this cause, zero-till systems have been encouraged as carbon sinks (Lal, 2004) [7] where mulching controls the water availability to accelerate the process. The acceptance of zero tillage systems has led to intensification of production in semiarid regions due to improvements in water use and water use efficiency (Hatfield *et al.*, 2001) [6]. Research in diverse regions, including Victoria, Australia (O’Leary and Connor, 1997b; Cantero-Martinez *et al*., 1999) [14, 3], Nebraska (Lyon *et al*., 1998) [10] and Texas, USA (Baumhardt and Jones, 2002) [1] suggested that zero tillage improved soil water storage compared to conventional tillage. (Lenssen *et al*., 2007) [8] documented the large, positive impact of summer fallow on subsequent spring wheat productivity and water use efficiency during drought in the northern Great Plains.

Mean Value of Treatments

Treatment	Plant population per sq. m)	Number of pods per plant	Moisture content at harvesting (%)	Ratio of seed: pod weight(g)	1000-seed weight(g)	Seed yield per plant(g)	Seed yield per square meter (g)
T1	157.32	76.10	18.73	0.248	16.50	0.808	198.80
T2	151.20	76.75	19.66	0.263	16.15	0.728	202.17
T3	158.45	97.95	19.00	0.283	16.73	0.870	228.32
T4	155.55	87.50	18.94	0.272	16.03	0.810	213.60
T5	161.92	73.70	18.84	0.285	15.70	0.715	202.95
T6	160.32	64.00	18.16	0.245	16.58	0.675	208.17
T7	152.05	103.50	17.88	0.265	16.70	0.935	215.12
T8	149.25	82.70	18.29	0.260	15.95	0.785	207.63
T9	150.23	79.40	1957	0.268	16.00	0.805	201.53
T10	153.80	98.85	18.95	0.257	16.43	0.933	213.48
Factors	***SE(m)***	***SE(m)***	**SE(m)**	***SE(m)***	***SE(m)***	***SE(m)***	***SE(m)***
T	1.64	0.91	0.10	0.003	0.17	0.009	2.23
V	0.73	0.41	0.05	0.001	0.08	0.004	1.00
T X V	2.32	1.29	0.15	0.004	0.25	0.012	3.15

Mean Value of Genotypes

Treatment	Plant population per sq. m)	Number of pods per plant	Moisture content at harvesting (%)	Ratio of seed: pod weight(g)	1000-seed weight(g)	Seed yield per plant(g)	Seed yield per square meter (g)
V1	152.43	82.68	18.89	0.273	16.68	0.797	212.24
V2	157.58	85.41	18.71	0.257	15.87	0.816	206.11

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