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PRODUCTIVITY OF BARLEY (*Hordeum vulgare* L.) GENOTYPES TO INTEGRATED NUTRIENT MANAGEMENT AND BROAD BED AND FURROW METHOD OF CULTIVATION IN WATERSHED AREA

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Abstract- A field experiment was conducted during *rabi* season of 2013-14 and 2014 -15 in farmer's field at model watershed, Neeralkatti village, Dharwad district of Karnataka to study the yielding ability of barley genotypes to INM and *in situ* moisture conservation practices. Significantly higher soil moisture was recorded in broad bed and furrow (BBF) at 0-15 and 15-30 cm depth at all the growth stages compared to flat bed. Significantly higher grain yield was obtained with genotype DWRB-73 sown on BBF with the application of RDF (50:25:0 N:P_2O_5:K_2O kg ha^{-1} + 7 t ha^{-1} FYM) *i.e.* (BBF x DWRB-73 x RDF, 2122 kg ha^{-1}) compared to rest of the interactions except it was on par with genotype DWRB-73 planted on BBF with the application of 75% N through urea + 25% N through vermicompost and recommended P through inorganics (2060 kg ha^{-1}). Similarly higher number of productive tillers per m row length (108.5), higher spike length (11.0 cm) and more test weight (62.5 g) was significantly higher with genotype DWRB-73 sown on BBF with the application of RDF (50:25:0 N:P_2O_5:K_2O kg ha^{-1} + 7 t ha^{-1} FYM) which was on par with application of 75% N through urea + 25% N through vermicompost and recommended P through inorganics.

Keywords- Soil moisture, 50% flowering, INM, Broad bed and furrow, yield attributes

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Introduction

Barley (*Hordeum vulgare*) has the widest ecological range of adaptation among the cereals, which is grown throughout the temperate and tropical regions of the world. It has low cost of production and input requirement, so it is preferred by the resource poor farmers in the country. Barley grains are considered for valuable input for industries for extracting malt to be utilized in brewing, distillation, baby foods, cocoa malt drinks and aryuvedic medicines. Its straw is a good quality fodder for livestock [1].

In India, rainfed areas face twin problems of poor fertility and deficit moisture supply for successful crop production. Cropping in the *kharif* season is not possible due to scanty and uncertain rainfall. Generally, crops are sown in October and are grown on stored moisture as there is little or no post- sowing rainfall. Hence, moisture is the major constraint in crop production during this season. This constraint can be alleviated by effective moisture conservation practices. The simple *in situ* moisture conservation technology developed to prevent or reduce water losses and to increase water intake is the Broad Bed and Furrow (BBF) method. This method is effective on black soils. It plays an important role in reducing the velocity when runoff occurs and increases the infiltration opportunity time and excess water is removed in large number of small furrows.

In order to meet the food demands for rising population in the first decades of the 21st century, farmers must manage nutrients and soil fertility in an integrated way. Integrated nutrient management (INM) is an approach that seeks to increase agricultural production as well as safeguard the soil environment for future generations. It is a strategy that incorporates both organic and inorganic nutrients to attain higher crop productivity. The fertilizer consumption in India including Karnataka is grossly unbalanced and tilted more towards nitrogen, followed by phosphorus. This has implications on yield response to fertilizer as it decreases the crop quality and adversely affects the overall soil fertility and productivity. Hence, judicious use of both organic and inorganic sources of nutrients will boost the crop productivity and soil health.

Materials and Methods

A field experiment was conducted during *rabi* season of 2013-14 and 2014 -15 in farmer's field at model watershed, Neeralkatti village, Dharwad district of Karnataka at $15^{0}\ 33^{1}\ 31.61^{11}$ N latitude and of $74^{0}\ 54^{1}\ 39.64^{11}$ E longitude with an altitude of 672 m above the mean sea level on deep black soil. The experiment was laid out in split-split plot design with three replications involving two *in-situ* moisture conservation practices *viz.* L_1: broad bed and furrow (BBF), L_2: farmer's practice (flat bed) as main plots, two genotypes as sub plots *viz.* G_1: DWRB-73 which is characterised as two row barley with grain/malting ability and G_2: BH-902 which was characterised as six row barley with fodder and grain ability and five integrated nutrient management practices *viz.* N_1: RDF (50:25:0

$N:P_2O_5:K_2O$ kg ha^{-1} + 7 t ha^{-1} FYM), N_2: 75% N through urea + 25% N through FYM and recommended P through inorganic, N_3 : 50% N through urea + 50% N through FYM and recommended P through inorganic, N_4: 75% N through urea + 25% N through vermicompost and recommended P through inorganic, N_5: 50% N through urea + 50% N through vermicompost and recommended P through inorganic as sub-sub plots. The soil of the experimental site was medium black clay with pH (7.62), EC (0.54 dS m^{-1}), organic carbon content was (0.52%), available N (260 kg ha^{-1}), P_2O_5 (15 kg ha^{-1}) and K_2O (304 kg ha^{-1}). The mean annual rainfall for the past 62 years at the Main Agricultural Research Station, Dharwad which is nearer to experimental field was 721.0 mm. Rain received during *kharif*-2013 and 2014 helped to store moisture in soil during *rabi* season.

Broad bed and furrow (BBF) was formed by using tropicultor 10 days before sowing of *kharif* crop (soybean). The BBF dimensions were 150 cm from furrow centre to centre of the adjacent furrow with raised bed of width 120 cm and height 15 cm. The farmyard manure and vermicompost were applied 10 days before sowing of the crop as per the treatment. Recommended dose of fertilizer 50:25:0 N, P_2O_5, K_2O kg ha^{-1} was applied in the form of urea and diammonium phosphate. Entire N and P_2O_5 were applied as basal. The barley varieties “DWRB-73” and “BH-902” were sown at a seed rate of 50 kg ha^{-1} as per the treatments. The data collected from the experiment subjected to statistical analysis as described by [2]. Further statistically analysed data were subjected to DMRT. The means followed by the same lower case letters did not differ significant.

Results and Discussion

Faulty land and crop management practices have resulted in loss of nearly 6000 mt of top fertile soil (16 t ha^{-1} $year^{-1}$) through erosion every year causing soil degradation in India. Under dry land conditions, soil and water conservation practices help to reduce runoff and soil erosion. At terrace level, erosion can be controlled by reducing slopes through bunds or live barriers whereas, at inter terrace level, it can be achieved by adopting various *in situ* moisture conservation practices. These soil and water conservation practices improve the soil moisture and nutrient status thereby sustaining the crop yields.

The *in situ* moisture conservation practice *i.e.*, broad bed and furrow recorded significantly higher soil moisture content at 0-15 cm and 15-30 cm soil depth at 30 DAS (24.1 and 25.8%, respectively), 60 DAS (18.5 and 21.5%, respectively) and at harvest (12.6 and 14.8%, respectively) compared to farmer’s practice [Table-1]. Higher soil moisture under broad bed and furrow was attributed to reduced runoff, soil erosion and higher infiltration rate in the soil. These results are in agreement with the findings [3] in barley. The substantial highest moisture in these treatments appears to be due to increased opportunity time for the rainwater to stand *in situ* and infiltrate into the deeper layers of soil profile [4]. The *in situ* moisture conservation practice like broad bed and furrow has been found to be effective in checking the soil erosion and runoff [5]. Crop yield under rainfed conditions mainly depend on the quantity of rainfall and its distribution that is reflected by the soil moisture content in the profile and supply to the crop at various growth stages. Availability of moisture at critical stages is very important. The results showed that broad bed and furrow recorded significantly higher soil moisture content over flat bed at all the soil depths. Thus, *in situ* moisture conservation practice has resulted in higher soil moisture content in the top 30 cm soil profile compared to flat bed. Similar trend was observed at different soil depths (0-15 cm and 15-30 cm) at all the growth stages of barley crop. This attribute is due to lower changes in soil moisture storage in broad bed and furrow laid out plot compared to farmer’s practice (Flat bed). These results are in agreement with the findings of [6] [Table-1].

The study revealed that genotype BH-902 taken more number of days to attain 50 per cent flowering (58.6 days) compared to DWRB -73 (54.1 days). This was due to inherent ability of genotype to avail more days to attain 50 per cent flowering. INM practices significantly influenced on number of days to attain 50 per cent flowering. Application of RDF (50:25:0 $N:P_2O_5:K_2O$ kg ha^{-1} + 7 t ha^{-1} FYM) recorded significantly less number of days (51.9) to attain 50 per cent flowering compared to rest of the treatments [Table-2]. This was due to higher concentration and uptake of nutrients by plants under fertilizer application which resulted in greater synthesis of protein and earlier flower primordial development which ultimately resulted in earlier flowering. These results are in concurrence with the findings of [7].

Among the *in situ* moisture conservation practices, pooled results indicated that broad bed and furrow recorded significantly higher grain yield and straw yield (1757 kg ha^{-1} and 3377 kg ha^{-1}, respectively) of barley compared to farmer’s practice [Table-2]. The yield increase was to the extent of 12.9 and 7.4 percent over farmer’s practice. This could be attributed to improved performance of growth and yield parameters through adequate availability of nutrients and soil moisture throughout the growing season, which in turn, favourably influenced physiological processes and build up of photosynthates. The increased yield of barley on BBF was mainly due to significant increase in number of productive tillers per m row length (94.4), spike length (8.5 cm) and test weight (48.0 g) compared to farmers’ practice. The improvement was to an extent of 9.8, 13.3 and 18.5 per cent, respectively [Table-2]. Water stress during the grain filling stage in farmer’s practice resulted in lighter grains. [8] asserted similar views of reduction in 1000-grain weight of rice under moisture stress. Higher grain yield per unit area in BBF was cumulative effect of total dry matter production over its crop growth stages. Reduced lodging of wheat at maturity on raised beds also lead to improved yield attributing characters and yield [9]. Additional sunlight entering the canopy during maturity stage resulted in better strength of the straw as a result of more drying of the soil around the base of the plant [10].

Among the genotypes, pooled results indicated that genotype DWRB-73 recorded significantly higher grain yield (1888 kg ha^{-1}) compared to genotype BH-902 (1415 kg ha^{-1}) [Table-2]. The yield increase was to the extent of 33.4 percent over BH-902. The increased yield of genotype DWRB-73 was mainly due to significant increase in number of productive tillers per m row length (94.7), spike length (9.4 cm) and test weight (53.0 g) compared to BH-902. The improvement was to an extent of 11.5, 46.8 and 52.3 per cent, respectively [Table-2] due to greater genetic ability of variety to translocate the photosynthates to economic part. Other factors which indirectly influenced the grain yield are growth attributes *viz.*, number of tillers and total dry matter production at harvest. Crop yield depends not only on the accumulation of photosynthates during the crop growth and development, but also on it’s translocation in the desired storage organs. These intern, are influenced by the efficiency of metabolic processes within the plant [3,11]. Genotype

BH-902 recorded significantly higher straw yield (3311 kg ha^{-1}) compared to DWRB-73 (3200 kg ha^{-1}) due to its ability to produce higher biomass as it is a dual type variety to produce both grain and fodder [12]. The improvement in the straw yield was to an extent of 3.5 per cent over DWRB-73 [Table-2]. It was observed that DWRB-73 genotype partitioned more than 9.1 per cent of its total dry mater production towards the economic parts of the plant.

Genotype BH-902 registered significantly more number of grains per spike (33.6) compared to DWRB-73 (24.5). This was due to genetic makeup of crop, as it is a characterised six row barley. Though more number of grains per spike in BH-902, it failed towards higher yield due to lower test weight. Genotype DWRB-73 registered significantly higher test weight (1000 grain weight) (53.0 g) compared to BH-902 (34.8 g) [Table-2]. This was due to greater genetic ability of variety to translocate the photosynthates from source to sink. The translocation of dry matter into grains was due to higher uptake of nutrients. The improvement in the harvest index to the tune of 23.7 per cent over BH-902 was due to higher translocation of assimilates from vegetative part to the reproductive parts of the plant.

Table 1- Soil moisture at 0-15 cm and 15-30 cm depth as influenced by integrated nutrient management under *in-situ* moisture conservation practices (Poole data of 2013-14 and 2014-15)

Treatment	Soil moisture (%) at 0-15cm depth			Soil moisture (%) at 15-30 cm depth		
	30 DAS	60 DAS	Harvest	30 DAS	60 DAS	Harvest
Main plot (Land management)-L						
L_1	24.1a	18.5a	12.6a	25.8a	21.5a	14.8a
L_2	20.1b	14.4b	10.4b	21.2b	16.6b	12.0b
S.Em +	0.2	0.08	0.09	0.16	0.15	0.17
Sub Plot (Genotypes)-G						
G_1	22.2a	16.3a	11.7a	23.5a	18.8a	13.2a
G_2	21.8a	16.1a	11.2a	23.3a	18.9a	13.2a
S.Em +	0.13	0.14	0.14	0.15	0.19	0.25
Sub sub (INM)-N						
N_1	22.0a	16.5a	11.6a	23.6a	19.0a	13.5a
N_2	22.1a	16.7a	11.5a	23.4a	19.0a	13.0a
N_3	22.2a	16.2a	11.4a	23.5a	19.2a	13.7a
N_4	21.8a	15.9a	11.6a	23.5a	18.8a	12.9a
N_5	21.9a	15.8a	11.1a	23.2a	18.4a	12.9a
S.Em +	0.36	0.31	0.17	0.4	0.32	0.27
Interaction (L x G x N)						
$L_1G_1N_1$	23.9a	18.4ab	12.9a	25.8a	21.3a	15.3ab
$L_1G_1N_2$	23.6a	19.5a	12.6a	25.5a	21.8a	13.7b-e
$L_1G_1N_3$	24.1a	18.3ab	12.6a	25.5a	21.3a	14.7ab
$L_1G_1N_4$	24.0a	17.8ab	12.5a	25.0ab	21.6a	14.5ab
$L_1G_1N_5$	24.1a	17.1bc	12.6a	25.7a	20.1a	13.9a-d
$L_1G_2N_1$	23.9a	18.7ab	12.9a	25.8a	21.8a	14.4ab
$L_1G_2N_2$	24.0a	17.7ab	12.4a	26.0a	20.8a	15.1ab
$L_1G_2N_3$	25.0a	18.2ab	12.4a	26.4a	22.0a	15.5a
$L_1G_2N_4$	22.9ab	17.3b	12.4a	25.9a	20.5a	14.8ab
$L_1G_2N_5$	23.3ab	17.8ab	12.4a	25.3a	21.0a	14.1a-c
$L_2G_1N_1$	21.3bc	14.7d	11.2b	22.7bc	16.9b	12.7c-f
$L_2G_1N_2$	20.2c	14.2d	10.6b-d	20.5c	16.1b	11.3f
$L_2G_1N_3$	20.4c	14.7d	10.9bc	21.7c	17.0b	12.2ef
$L_2G_1N_4$	20.2c	14.4d	11.2b	22.0c	15.8b	11.3f
$L_2G_1N_5$	20.4c	13.9d	9.9cd	21.1c	16.4b	12.2ef
$L_2G_2N_1$	19.0c	14.0d	9.5d	20.1c	15.8b	11.6ef
$L_2G_2N_2$	20.5c	15.3cd	10.4b-d	21.7c	17.3b	12.0d-f
$L_2G_2N_3$	19.2c	13.8d	9.6d	20.2c	16.5b	12.4f
$L_2G_2N_4$	20.0c	14.2d	10.1cd	21.2c	17.3b	11.1f
$L_2G_2N_5$	19.8c	14.4d	9.6d	20.8c	16.2b	11.4f
S.Em +	0.72	0.63	0.34	0.8	0.64	0.53

The means followed by the same lower case letters in a column do not differ significant by DMRT

DAS: Days after sowing; L_1: BBF; G_1: DWRB-73; L_2: Farmer's Practice; G_2: BH-902;

N_1:RDF (50:25:0 N:P_2O_5:K_2O kg ha^{-1}+ 7 t ha^{-1} FYM)

N_2:75% N through urea + 25% N through FYM and recommended P through inorganics

N_3:50% N through urea + 50% N through FYM and recommended P through inorganics

N_4: 75% N through urea + 25% N through Vermicompost and recommended P through inorganics

N_5: 50% N through urea + 50% N through Vermicompost and recommended P through inorganics

Among the integrated nutrient management practices, pooled results showed significantly higher grain yield (1775 kg ha^{-1}) and straw yield (3392 kg ha^{-1}) with application of RDF (50:25:0 $N:P_2O_5:K_2O$ kg ha^{-1} + 7 t ha^{-1} FYM) which was on par with the application of 75% N through urea + 25% N through vermicompost and recommended P through inorganics (1724 kg ha^{-1}grain yield and straw yield 3335 kg ha^{-1}) followed by the application of 75% N through urea + 25% N through FYM and recommended P through inorganics. Whereas, significantly lower grain yield (1521 kg ha^{-1}) and straw yield (3106 kg ha^{-1}) were obtained with the application of 50% N through urea + 50% N through FYM and recommended P through inorganics. The grain yield of barley with RDF was more to an extent of 6.0, 16.7, 3.0 and 13.4 percent over N_2, N_3, N_4 and N_5, respectively. The factors mainly responsible for variation in the grain yield of barley are due to variations in the performance of yield components *viz.*, productive tillers per m row length (97.0), spike length (8.9 cm) and test weight (49.1 g) at harvest which was on par with the application of 75% N through urea + 25% N through vermicompost and recommended P through inorganic [Table-2]. The increase was to an extent of 5.4, 18.7, 2.6 and 15.3 percent respectively for productive tillers per m row length, 6.0, 32.8, 3.5 and 29.0 percent, respectively for spike length, and test weight (7.2, 29.5, 3.6 and 24.9 percent, respectively) compared to N_2, N_3, N_4 and N_5 respectively.

Table 2- Yield and yield attributes of barley genotypes as influenced by integrated nutrient management under *in-situ* moisture conservation practices (Poole data of 2013-14 and 2014-15)

Treatment	Days to 50% flowering	Productive tillers (m^{-1} row length)	Spike length (cm)	Grains per spike	Test weight (g)	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Harvest index (%)
Main plot (Land management)-L								
L_1	55.1a	94.4a	8.5a	30.9a	48.0a	1757a	3377a	34.1a
L_2	55.5a	86.0b	7.5b	27.6b	40.5b	1556b	3142b	32.9a
S.Em +	0.28	0.3	0.04	0.26	0.32	32.5	38.4	0.2
Sub Plot (Genotypes)-G								
G_1	54.1b	94.7a	9.4a	24.5b	53.0a	1888a	3200b	37.0a
G_2	58.6a	84.9b	6.4b	33.6a	34.8b	1415b	3311a	29.9b
S.Em +	0.29	0.4	0.05	0.24	0.4	13.9	16.1	0.12
Sub sub plot (INM)-N								
N_1	51.9c	97.0a	8.9a	32.7a	49.1a	1775a	3392a	34.2a
N_2	55.0b	92.0b	8.4b	30.2b	45.8b	1674b	3280b	33.6b
N_3	59.1a	81.7c	6.7c	24.8c	37.9c	1521c	3106c	32.7c
N_4	55.9b	94.5ab	8.6ab	31.5ab	47.4ab	1724ab	3335ab	33.9ab
N_5	60.1a	84.1c	6.9c	26.0c	39.3c	1565c	3163c	32.9c
S.Em +	0.33	0.88	0.08	0.43	0.57	17.5	19.8	0.12
Interaction (L x G x N)								
$L_1G_1N_1$	49.6d	108.5a	11.0a	29.2fg	62.5a	2122a	3456bc	38.0a
$L_1G_1N_2$	52.4c	101.3bc	10.4bc	27.0g-i	57.4bc	2019b	3341c-e	37.6ab
$L_1G_1N_3$	56.3b	91.2d-f	8.8g	21.7kl	50.9d	1854c	3164f-h	36.9b-d
$L_1G_1N_4$	53.2c	105.0ab	10.7ab	27.9gh	60.5ab	2060ab	3397b-d	37.7ab
$L_1G_1N_5$	57.3b	94.4de	8.9fg	22.3jk	52.7d	1909c	3223e-g	37.2bc
$L_1G_2N_1$	54.1c	95.3de	7.7h	39.6a	43.7ef	1634cd	3570a	31.4f
$L_1G_2N_2$	57.2b	89.7f-h	7.5h	36.5bc	40.6f	1535de	3455bc	30.8fg
$L_1G_2N_3$	61.3a	80.2kl	5.6j	31.4ef	32.8g	1381f	3279d-f	29.6h
$L_1G_2N_4$	57.9b	92.7d-f	7.5h	38.5ab	41.8ef	1591cd	3508ab	31.2f
$L_1G_2N_5$	62.1a	82.4i-k	5.8j	32.5e	34.1g	1427f	3337c-e	29.9h
$L_2G_1N_1$	49.8d	96.3cd	9.9cd	26.5g-i	54.4cd	1904c	3221e-g	37.1bc
$L_2G_1N_2$	53.0c	92.4d-f	9.4ef	24.7ij	51.0d	1805c	3104g-i	36.7c-e
$L_2G_1N_3$	57.2b	81.0j-l	7.7h	19.3l	43.4ef	1658d	2941j	36.0e
$L_2G_1N_4$	54.2c	93.7de	9.7de	25.7hi	52.6d	1857c	3164f-h	36.9b-d
$L_2G_1N_5$	58.2b	83.7i-k	7.9h	20.7kl	44.7e	1695d	2987ij	36.2de
$L_2G_2N_1$	54.1c	87.9f-h	6.8i	35.5cd	35.7g	1438ef	3321de	30.2gh
$L_2G_2N_2$	57.1b	84.4i-k	6.4i	32.9e	34.3g	1339f	3222e-g	29.4h
$L_2G_2N_3$	61.7a	74.2m	4.7k	26.7g-i	24.4h	1189g	3043h-j	28.1i
$L_2G_2N_4$	58.2b	86.5h-j	6.6i	33.9de	34.8g	1389f	3270d-f	29.8h
$L_2G_2N_5$	62.9a	75.7lm	4.9k	28.5g	25.7h	1230g	3105g-i	28.4i
S.Em +	0.66	1.76	0.16	0.85	1.14	35	39.5	0.25

The means followed by the same lower case letters in a column do not differ significant by DMRT

DAS: Days after sowing; L_1: BBF; G_1: DWRB-73; L_2: Farmer's Practice; G_2: BH-902;

N_1:RDF (50:25:0 $N:P_2O_5:K_2O$ kg ha^{-1}+ 7 t ha^{-1} FYM)

N_2:75% N through urea + 25% N through FYM and recommended P through inorganics

N_3:50% N through urea + 50% N through FYM and recommended P through inorganics

N_4: 75% N through urea + 25% N through Vermicompost and recommended P through inorganics

N_5: 50% N through urea + 50% N through Vermicompost and recommended P through inorganics

Under rainfed conditions, the synergistic effects of soil and moisture conservation practices and integrated nutrient management practices are more effective than their individual effects. Significantly higher grain yield was obtained with interaction of genotype DWRB-73 sown on BBF with the application of RDF (50:25:0 $N:P_2O_5:K_2O$ kg ha^{-1} + 7 t ha^{-1} FYM) (BBF x DWRB-73 x RDF, 2122 kg ha^{-1}) compared to rest of the interactions except it was on par with $L_1G_1N_4$, (2060 kg ha^{-1}) *i.e.* genotype DWRB-73 planted on BBF with the application of 75% N through urea + 25% N through vermicompost and recommended P through inorganics. The increase in grain yield with BBF x RDF was due to integrated effect of *in situ* moisture conservation and integrated nutrient management practices and also individual effects of interaction components which might have also contributed for the significance of the interaction [Table-2]. The yield increase in BBF x DWRB -73 x RDF *i.e.*, genotype raised on broad bed and furrow along with application of RDF (50:25:0 $N:P_2O_5:K_2O$ kg ha^{-1} + 7 t ha^{-1} FYM) was attributed to significantly higher dry matter production at harvest, higher number of productive tillers per m row length (108.5), higher spike length (11.0 cm) and more test weight (62.5 g) which was on par with application of 75% N through urea + 25% N through vermicompost and recommended P through inorganics ($L_1G_1N_4$). The improvement in moisture content as well as higher nutrient availability resulted in higher uptake of N, P, K and contributed to increased barley grain yield. The favourable effect of BBF together with RDF in improving the soil fertility might be attributed to more mineralization of nutrients [13] [Table-2].

Significantly higher straw yield was obtained with interaction of genotype BH-902 sown on BBF with the application of RDF (50:25:0 $N:P_2O_5:K_2O$ kg ha^{-1} + 7 t ha^{-1} FYM) (BBF x BH-902 x RDF, 3570 kg ha^{-1}) [Table-2] compared to rest of the interactions except that it was on par with $L_1G_2N_4$, (3508 kg ha^{-1}) *i.e.* genotype BH -902 sown on BBF with the application of 75% N through urea + 25% N through vermicompost and recommended P through inorganics. The increase in straw yield with BBF x RDF was due to inherent potential of genotype (BH-902) to produce more biomass as it is dual type variety *i.e.* for both fodder and grain coupled with better storage of moisture with *in situ* moisture conservation practice (BBF), integrated nutrient management practices and also individual effects of interaction components which might have also contributed for the significance of the interaction.

Conclusion

Significantly higher soil moisture was recorded in broad bed and furrow at 0-15 and 15-30 cm depth at all the growth stages compared to flat bed and significantly higher number of productive tillers, spike length, test weight, grain yield was recorded with the genotype DWRB-73 raised on broad bed and furrow along with the application of RDF (50:25:0 N: P_2O_5: K_2O kg ha^{-1} + 7 t ha^{-1} FYM) and it was on par with DWRB-73 raised on BBF with application of 75% N through urea + 25% N through vermicompost and recommended P through inorganics.

Conflicts of Interest: None declared.

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