IJFANS INTERNATIONAL JOURNAL OF FOOD AND NUTRITIONAL SCIENCES

ISSN PRINT 2319 1775 Online 2320 7876

 UGC CARE Listed (Group -I) Journal Volume 10, Iss 10, 2021

To conduct research on Preparatory Tillage, Nutrient Managements and Moisture Conservation Practices as Response on Yield, Effective Fresh and Dry Weight of Barley Cultivation under Water Stress Condition

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ABSTRACT

A field experiment were conducted for two consecutive rabi seasons during 2017-18 and 2018-19 at Faculty of Agricultural Sciences and Allied Industries, Rama University, Mandhana, Kanpur, U.P. 209217 on Gangatic alluvial soil having 7.6 pH, light textured soil with medium soil fertility. Treatments comprises of viz., 3- preparatory tillage 1) T1 - one cross ploughing with cultivator, 2) T2 - one ploughing with disc harrow + one cross ploughing with cultivator and 3) T3- one ploughing with disc harrow + one pass with rotavator, 3- nutrient management practices i.e. 1.) N1-100% RDF (60 Kg N ha-1 + 30 Kg P2O5 ha-1+ 30 Kg K2O ha-1) (through chemical fertilizer), 2.) N2- 75% RDF (through chemical fertilizer) + 25% FYM (Farm yard manure) and 3.) N3-50% RDF (through chemical fertilizer) +50% FYM (Farm yard manure) and 3- moisture conservation practices viz., 1.) M1- Control, 2.) M2- dust mulch and 3.) M3--pinoxaden 5.1 EC @ 50 g ha-1 + VAM @ 15 Kg ha-1) was researches. It is clear from the results of two year experimentation that sowing of barley crop in plots where preparatory tillage, T3- one ploughing with disc harrow + one pass with rotavator, nutrient applied as N3-50% RDF (through chemical fertilizer) + 50% FYM (farm yard manure) and moisture conservation practices of M3-pinoxaden 5EC @ 50 g/ha. + VAM @ 15 Kg/ha brought out the maximum values of grain yield, straw yield, biological yield, fresh and dry weight of barley observed during both the years of study respectively followed by T2- one ploughing with disc harrow + one cross ploughing with cultivator, N2 treatment- 75% RDF + 25% FYM and M2- dust mulch, and minimum values of treatments i.e., T1 - one cross ploughing with cultivator, N1-100% RDF (60 Kg N ha-1 + 30 Kg P2O5 ha-1+ 30 Kg K2O ha-1) (through chemical fertilizer) and moisture conservation practices of M1-control treatment in both year respectively.

Introduction

Barley is sown during October-November and harvested from March to April. India's annual production has been stable at 1.6 to 1.8 million metric tonnes in recent year during 2020, and

ISSN PRINT 2319 1775 Online 2320 7876

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2019 it was 1687 and 1,633 thousand tonnes. The area under cultivation has also remained stagnant at 0.65-0.7 m ha, with a per-hectare yield of around 1,944 kg. In India, barley is largely grown in the states of Uttar Pradesh, Rajasthan and Madhya Pradesh, with a contribution of 34%, 30% and 12% respectively, in total acre. These states account for about 80% of the total acre. Although Uttar Pradesh ranks first in terms of acreage, barley tops in terms of production, due to good yield level in the state. Uttar Pradesh accounts for 34% of total production followed by Rajasthan (30%) and Madhya Pradesh (12%). (Anonymous, 2020). In India, barley is cultivated as a winter crop. It is grown in a wide range of agro-climatic regions under several production systems, at altitudes of about 3000 MSL or above, it may be the only crop grown that provides food, beverages and other necessities to many millions of people. Barley grows best on well-drained soils and can tolerate higher levels of soil salinity than most other crops.

Food barley is commonly cultivated in stressed areas where soil erosion, occasional drought or frost limits the ability to grow other crops (Tapanarova, 2005). Investigated that the tillage during intermittent drought period effectively conserved the soil moisture and significantly increased the seed yield of barley. It is recommended that field bounding, deep ploughing during monsoon and straw mulching @ 5 t ha-1 may be followed for enhancement of barley seed yield and water productivity through in-situ moisture conservation (Regar et al., 2009).
Barley *(Hordeum vulgare* L.) is an important *rabi season* cereal crop of dryland· agriculture due to its ability to tolerate the drought, fluctuation in temperature, biotic and abiotic stresses. Barley has been grown for centuries under stress conditions in marginal and problematic lands with the result that both natural and human selection have favored its development of types that are characterized more for their capacity to survive under low yielding environments with lower agro-management conditions. A small portion of barley malt is used in food products principally to enhance flavor, however, the major use of barley malt is in the production of alcoholic beverages. Although alcoholic beverages are not foods. In the strict sense, they do contribute some nutrition, either with or a part from meals to the diet. So it induces rapid growth, increases leaf size and improves quality, promotes fruit and seed development. The insufficient amount of nitrogen can reduce the quality below acceptable levels, while high nitrogen fertilizer rates can result in translocation of sufficient amount of nitrogen from vegetative organs to the grain, resulting in high grain protein content. VAM colonization was more beneficial to plants under the complete nutrient treatment than under the tap water treatment (Titus, Jonathan H. and del Moral, Roger (1998) A field experiment conducted “yield maximization through nutrient management in barley was carried out at Instructional Farm, Department of Agronomy, College of Agriculture, Junagadh Agricultural University, and Junagadh during the *rabi* season of 2015-16. The experiment comprising ten treatments of nutrient management *viz*., T1 (control), T2 (RDF 120:60:60 NPK kg ha-1), T3 (75% N from urea + 25% N from FYM), T4 (FYM @ 10 t ha-1), T5 [RDF + ZnSO4 @ 25 kg ha-1 (P from DAP)], T6 [RDF + ZnSO4 @ 25 kg ha-1 (P from SSP)], T7 [RDF (N from Zn coated urea + P from SSP)], T8 (75% RDF + *Azotobacter* + PSB), T9 [RDF (N from neem coated urea + P from SSP)] and T10 (RDF 50% N from neem

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coated urea + 50% N from Zn coated urea + P from SSP) were evaluated in randomized block design with three replications. Akhtar, Nosheen *et al.,* (2018).

Materials and Methods

A field trail was conducted during *(rabi season)* of 2017-18 and 2018-19 at Soil Conservation and Water Management Farm of the Faculty of Agricultural Sciences and Allied Industries, Rama University, Mandhana, Kanpur, U.P. 209217, on gangatic alluvial soil having 7.6 Ph, light textured soil with medium soil fertility. In Kanpur region average rainfall is approximately 800-850mm annually.

Experimental details The experiment was laid down in Split Plot Design in a 3 replication 27 plot comprising 3 Preparatory tillage and 3 Nutrient managements with 3 Moisture conservation practices system.

Preparatory tillage (T): (i) one cross ploughing with cultivator, (ii) one ploughing with disc harrow + one cross ploughing with cultivator (iii) one ploughing by disc harrow + one pass with rotavator

Nutrient managements (N): (i) 100% RDF (60 Kg N + 30 Kg P + 30 Kg K /ha) (ii) 75% RDF + 25% FYM (iii) 50% RDF +50% FYM

Grain Yield (q ha-1) After taking the weight of total biomass, the produce of each net plot was threshed separated manually. The grains of each plot were cleaned and air dried to maintain the moisture content at standard level of 14 % and recorded the weight in kg per net plot by balance. Finally grain yield per plot was converted in to q ha-1 by conversion factor. Straw Yield (q ha-1) Straw yield was recorded by subtracting the weight of grains from the weight of total harvested produced of each net plot. Thus the straw yield obtained in kg per plot was multiplied with the conversion factor in order to get straw yield in q ha-1.Biological Yield (q ha-1) The biological yield was obtained at harvest from each plot by taking bundle weight and recorded as kilogram per plot. This was converted into q ha-1 by multiplying factor for statistical analysis.

Summary and conclusion

Moisture conservation practices (M): (i) Control, (ii) Dust mulch (iii) Pinoxaden 5EC @ 50 g/ha + VAM @ 15 Kg/ha Results and Discussion Yield of barley crop Effect of Preparatory tillage, Nutrient managements and Moisture conservation practices on grain yield, straw yield and biological yield of barley crop were analyzed statistically the results of both years have been presented in Table-1. Among highest yield (grain yield (26.52 & 28.18 q/ha), straw yield (36.55 & 38.41 q/ha) & biological (62.34 & 66.60 q/ha) of preparatory tillage T3) one ploughing with disc harrow + one cross ploughing with rotavator, followed by T2) one ploughing with disc harrow + one cross ploughing with cultivator. While minimum grain yield (25.25 & 25.86 q/ha), straw yield (32.56 & 32.15 q/ha) & biological (57.60 & 57.01 q/ha) obtained a plots where T1)

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one cross ploughing with cultivator during both year. As similar to Morell et al., (2011), Bajwa et al., (2002). Among nutrient management treatments highest yield (grain yield (q/ha) (27.14 & 28.33), straw yield (q/ha) (36.72 & 39.30) and biological yield (q/ha) (63.49 & 67.64) of barley obtained in plots where N3) 50% recommended dose of fertilizer of ploughed with 50% farm yard manure (FYM) followed by application of N1) 75 percent fertilizer dose through chemical fertilizer with 25% farm yard manure however minimum grain yield (24.39 & 25.21), straw yield (q/ha) (31.78 & 32.09) and biological yield (q/ha) (56.19 & 57.30) of barley recorded under treatment N1- 100% during 2017-18 & 2018-19 respected (Hemmat and Eskandari, 2006). Various treatment of moisture conservation practices significantly affect the barley yield, maximum grain yield (27.60 & 27.77 q/ha), straw yield (q/ha) (37.78 & 38.63) and biological yield (q/ha) (65.41 & 66.40) of barley recorded in plots where M3) pnoxaden 5EC @ 50g ha-1 + VAM @ 15 Kg ha-1 followed by M2) dust mulch while minimum grain yield (23.66 & 25.64 q/ha), straw yield (30.90 & 32.63 q/ha) and biological yield (54.47 & 58.28 q/ha) recorded in plots where use moisture conservation practices of M1) control during both the year of experimentation respectively. Fersh and dry weight of barley Effect of Preparatory tillage, Nutrient managements and Moisture conservation practices on fresh and dry weight of barley were analyzed statistically the results of both years have been presented in Table- 2 & 3. It is clear from the results presented in table-2. that preparatory tillage treatment- T3) one ploughing with disc harrow + one pass with rotavator, application of nutrient- N1) 50% RDF +50% FYM and moisture conservation practices- M3) pinoxaden 5.1 EC @ 50 g ha-1 + VAM @ 15 Kg ha-1 produced the highest Fresh weight plant-1 (g) at, 60 DAS, 90 DAS and at maturity during both the years. The lowest Fresh weight plant-1 (g) was noted in tillage treatment T1) one cross ploughing with cultivator, nutrient management N1)100% RDF (60 Kg N + 30 Kg P2O5 + 30 Kg K2O ha-1) and moisture conservation practices M1) control at all the stages of observations during 2017-18 and 2018-19 respectively.

It is appear at from the data give in table-3 that dry weight (g) of increased with in crossed in day of sowing, preparatory tillage significantly increased the dry weight (g) of barley and record highest dry weight (g) (60, 90 DAS and maturity DAS) under treatment T3) one ploughing with disc harrow + one pass with rotavator followed by treatment T2) one ploughing with disk harrow + one cross ploughing with cultivator. While lowest dry weight (g) per plant recorded under treatment T1) one cross ploughing with cultivator. Among nutrient management treatment as increase organic matter as dry weight of plant. Highest dry weight was recorded with application of N3) 50% RDF through chemical fertilizer + 50% FYM, followed by N2 treatment 75% RDF + 25% FYM. While minimum fresh weight of plant observed with application of N1) 100% RDF through chemical fertilizer. Moisture conservation practices significantly affected the dry weight (g) plant of barley. Application of M3) pinoxaden 5EC @ 50 g ha-1 + VAM @ 15 Kg ha-1 produced highest dry weight (g) per plant of barley and minimum under M1) control during both the year of experiment respectively.

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Table.1 Effect of preparatory tillage, Nutrient managements and moisture conservation practices on grain yield, straw yield and biological yield of barle

Treatments	GrainYield		StrawYield		Biological Yield	
	2017-18	2018-19	2017-18	2018-19	2017-18	2018-19
PreparatoryTillage(T)						
T_1-Onecrossploughingwith cultivator	25.25	25.86	32.56	32.15	57.60	57.01
T_2-One ploughing with disc harrow+onecrossploughing withcultivator	25.74	27.17	34.25	35.96	59.91	63.23
T_3-Oneploughingby discharrow + onepass with rotavato	26.52	28.18	36.55	38.41	62.34	66.60
SE(d)	0.45	0.52	0.98	1.15	1.19	1.42
CD(P=0.05)	0.95	1.10	2.09	2.47	2.53	3.94
NutrientManagement(N)						
N_1-100%RDF	24.39	25.21	31.78	32.09	56.19	57.30
N_2-75% RDF+25%FYM	25.98	26.66	34.86	35.23	60.15	62.90
N_3-75% RDF+25%FYM	27.14	28.33	36.72	39.30	63.49	67.64
SE(d)	0.450	0.52	0.98	1.16	1.19	1.42
CD(P=0.05)	0.954	1.10	2.09	2.47	2.53	3.94
MoistureConservationPractices(M)						
M_1–Control	23.66	25.64	30.90	32.63	54.47	58.28
M_2-Dust mulch	26.26	26.79	34.68	35.36	59.96	62.16
M_3-Pinoxaden5EC@50g/ha+ VAM @ 15 Kg/ha	27.60	27.77	37.78	38.63	65.41	66.40
SE(d)	0.58	0.6	1.28	1.45	1.22	1.47
CD(P=0.05)	1.18	1.38	2.59	2.94	2.47	2.98

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Table.2 Effect of tillage preparatory, nutrient managements and moisture conservation practices on fresh weight (g)/plant of barley.

Treatments	60DAS		90DAS		ATMATURITYDAS	
	2017-18	2018-19	2017-18	2018-19	2017-18	2018-19
PreparatoryTillage(T)						
T_1 -Onecrossploughingwith cultivator	108.97	116.83	149.42	158.02	26.03	27.94
T_2 -One ploughing with disc harrow + one cross ploughing with cultivator	110.80	118.47	149.64	160.02	26.45	28.29
T_3-Oneploughingbydisc harrow + one pass with rotavator	114.03	122.02	154.02	164.82	27.23	29.08
SE(d)	1.62	1.89	1.80	1.98	0.43	0.41
CD(P=0.05)	3.44	4.01	3.82	4.20	0.91	0.87
NutrientManagement(N)						
N_1-100%RDF	105.07	112.70	144.12	152.22	25.10	26.91
N_2-75% RDF+25%FYM	111.94	119.84	151.20	161.86	26.73	28.55
N_3-75% RDF+25%FYM	116.80	124.78	157.76	168.76	27.88	29.84
SE(d)	1.62	1.89	1.80	1.98	0.43	0.41
CD(P=0.05)	3.44	4.01	3.82	4.20	0.91	0.87
MoistureConservationPractices(M)						
M_1–Control	101.88	109.42	137.62	148.02	24.32	26.17
M_2-Dust mulch	113.15	121.48	155.04	164.08	27.02	28.95

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M_3-Pinoxaden5EC@50 g/ha + VAM @ 15 Kg/ha	118.77	126.42	160.40	170.76	24.37	30.19
SE(d)	1.65	1.92	1.84	2.02	0.44	0.40
CD(P=0.05)	3.31	3.86	3.70	4.06	0.89	0.82

Table.3 Effect of tillage preparatory, nutrient managements and moisture conservation practices on dry weight (g)/plant of barley.

Treatments	**60DAS**		**90DAS**		**ATMATURITYDAS**	
	2017-18	**2018-19**	**2017-18**	**2018-19**	**2017-18**	**2018-19**
PreparatoryTillage(T)						
T_1 -Onecrossploughingwith cultivator	8.41	8.59	16.31	16.74	18.28	18.75
T_2 -One ploughing with disc harrow + one cross ploughing with cultivator	8.52	8.73	16.30	16.96	18.27	18.97
T_3-Oneploughingbydisc harrow + one pass with rotavato	8.79	9.03	17.04	17.51	19.09	19.62
SE(d)	0.12	0.15	0.28	0.35	0.33	0.33
CD(P=0.05)	0.25	0.32	0.59	0.74	0.70	0.70
NutrientManagement(N)						
N_1-100%RDF	8.09	8.27	15.68	16.11	17.57	18.05
N_2-75% RDF+25%FYM	8.63	8.84	16.75	17.15	18.77	19.22
N_3-75% RDF+25%FYM	8.99	9.24	17.22	17.92	19.29	20.08
SE(d)	0.12	0.15	0.28	0.35	0.33	0.33
CD(P=0.05)	0.25	0.32	0.59	0.74	0.70	0.70
MoistureConservationPractices(M)						
M_1–Control	7.87	8.04	15.26	15.67	17.10	17.56
M_2-Dust mulch	8.71	8.96	16.66	17.38	18.66	19.47

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M_3-Pinoxaden5EC@50 g/ha + VAM @ 15 Kg/ha	9.14	9.35	17.72	18.13	19.86	20.31
SE(d)	0.12	0.12	0.29	0.30	0.34	0.32
CD(P=0.05)	0.24	0.25	0.58	0.61	0.69	0.65

In conclusion the significantly highest grain yield (26.52 &28.18 q/ha), straw yield (36.55 & 38.41 q/ha) and biological yield (62.34 & 66.60 q/ha) of barley was obtained with preparatory tillage operation of T_3) one ploughing with disc harrow + one pass with rotavator followed by T_2) one ploughing with disc harrow + one cross ploughing with cultivator of grain yield (25.74 &27.17 q/ha), straw yield (34.25& 36.06 q/ha) andbiological yield (59.91& 63.23 q/ha). Lowest grain yield (25.25 & 25.86 q/ha), straw yield (32.56 & 32.15 q/ha) and biological yield (57.60 & 57.01 q/ha) of barley was recorded in preparatory tillage operation given at T_1) one cross ploughing with cultivator during experimental year. However, some studies have reported that no tillage didn't increase the crop yield (Monneveux *et al.*, 2006; Masek and Novak, 2018). Baigys *et al.*, (2006). Maximum grain yield (27.14 & 28.33 q/ha), straw yield (36.30 & 39.72 q/ha) and biological yield (63.49 & 67.64 q/ha) ofbarley was obtained with significantlynutrient managements practices of N_3 50% RDF+50%FYMfollowedbyN2)75%RDF + 25% FYM of grain yield (25.98 & 26.66 q/ha), straw yield (34.86 & 35.23 q/ha) and biological yield (60.15 & 62.90 q/ha). Minimum grain yield (24.39 & 25.21 q/ha), straw yield (31.78 & 32.65) and biological yield (56.19& 57.30 q/ha) of barley was recorded in nutrient managements practices givenatN1)100%RDF(60KgN+30KgP + 30 Kg K /ha) recommended dose through chemical fertilizer during experimental year.

As camper to Sharma *et al.*, (2001), consummate yield of barley was obtainedwith significantly moisture conservation practices of T_3) pinoxaden 5EC @ 50 *a.i.*g/ha. (as post emergence) + VAM @ 15Kg/ha of grain yield (27.60 & 27.77 q/ha), straw yield (37.78 & 38.63 q/ha) and biological yield (65.41& 66.40 q/ha) compared to rest of M_2) dust mulch-grain yield (26.26 & 26.79 q/ha), straw yield (34.68& 35.36 q/ha) and biological yield (59.96 & 62.16 q/ha). Minimum grain yield, straw yield and biological yield of barley was recorded in moisture conservation practices given at M_1) control (23.66 & 25.64 q/ha), (30.90&32.63)and(54.74&58.28q/ha) with cultivator during 2017-18 &2018-19 respectively (Dinka *et al.*, 2018).

Preparatory tillage operation of barley givenat T_3) one ploughing with disc harrow + one pass with rotavator, followed by practices T_2) one ploughing with disc harrow + one cross ploughing with cultivator increased fresh and dry weight plant^{-1} at all stages (60DAS, 90DAS and maturity) of barley as compared to first year to second year, minimum fresh and dry weight plant^{-1} of barley was obtained in preparatory tillage operation given at T_1) one cross ploughing with cultivator.Under nutrient managements practices of barley given at N_3) 50% RDF (application through chemical fertilizer) + 50% FYM (farm yard manure), was increased fresh and dry weight plant^{-1} at all stages (60DAS, 90DAS and maturity) of barley as compared to first year to second year.

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Minimum fresh and dry weight plant^{-1} of barley was obtained under nutrient managements practices given at N_1) 100% RDFduringboththeyear of2017-18&2018-19 respectively, and to conduct experiment was use of moisture conservation practices of barley given at T_3) pinoxaden 5EC @ 50 *a.i.* g/ha. (as post emergence) + VAM @ 15 Kg/ha, was consummate fresh and dry weight plant^{-1} at all stages ofbarleyduringboth year, minutestfreshanddryweightplant^{-1}ofbarley was obtained in moisture conservation practices given at M_3) control during 2017-18 and2018-19.Assuchas ofMohammad*et al.,* (2012).

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