EFFECT OF PRELIMINARY TILLAGE, NUTRIENT MANAGEMENTS AND MOISTURE CONSERVATION PRACTICES AS REACTION ON GROWTH METRICS AND YIELD ATTRIBUTES OF BARLEY CULTIVATION UNDER WATER STRESS CONDITION

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Abstract

A field experiment were conducted for two consecutive rabi seasons during 202-23 and 2023-24 at Agriculture farm, Rama University Kanpur on gangatic alluvial soil having 7.6 pH, light textured soil with medium soil fertility. Treatments comprises of viz., three preparatory tillage T1 - one cross ploughing with cultivator, T2 - one ploughing with disc harrow + one cross ploughing with cultivator and T3- one ploughing with disc harrow + one pass with rotavator, three nutrient management practices i.e. N1-100% RDF (60 Kg N ha-1 + 30 Kg P_2O_5 ha-1+ 30 Kg K_2O ha-1) through chemical fertilizer, N2-75% RDF(through chemical fertilizer) + 25% FYM (Farm yard manure) and N3-50% RDF (through chemical fertilizer) +50% FYM (Farm yard manure) and three moisture conservation practices viz., 1) M1- Control, 2) Research was done on M2-Dust mulch and M3-Pinoxaden 5.1 EC @ 50 g a.i ha-1 + VAM @ 15 Kg ha-1. The findings of the two-year experiment show that planting barley in plots with preparatory tillage, T3 (one ploughing with a disc harrow and one pass with a rotavator), nutrient application as N3-50% RDF through chemical fertiliser + 50% FYM, and moisture conservation techniques of M3-pinoxaden 5EC @ 50 g/ha. + VAM @ 15 kg/ha, respectively, produced the highest values of growth parameters, yield attributes, and the days of flowering and maturity of barley during the two study years. T1 was then planted with a cultivator and N1-100% RDF (60 Kg N ha-1 + 30 Kg P_2O_5 ha-1 + 30 Kg K_2O ha-1) through chemical fertiliser and a-1+ 30 Kg K_2O ha-1) through chemical fertilizer

Keywords: preparatory tillage- T1- one cross ploughing with cultivator, T2- one ploughing with disc harrow + one cross ploughing with cultivator, T3- one ploughing by disc harrow + one pass with rotavator, nutrient management practices- N1-100% RDF (60 Kg N ha-1 + 30 Kg P_2O_5 ha-1+ 30 Kg K_2O ha-1), N2-75% RDF + 25% FYM (Farm yard manure), N3-50% RDF +50% FYM (Farm yard manure).

Introduction

Barley may be the only crop produced that supplies food, drink, and other essentials to millions of people. It is grown in a variety of agroclimatic zones under multiple production systems at elevations of roughly 3000 MSL or above. Unlike most other crops, barley can withstand higher soil salt levels and thrives on well-drained soils. Food barley is frequently grown in challenged regions where other crops cannot be grown due to soil erosion, sporadic drought, or frost (Tapanarova, A. 2005).

It is also known to contain oil compounds called tocotrienols and water-soluble fibre called beta glucans, both of which have been shown to effectively lower blood cholesterol levels. Hay and silage can also be made from barley straw. Its grains are a staple food, cow feed, and malt used to make beer and other spirits products. In addition to minerals and vitamin B complex, they include 8–10% protein and 74% carbs. Barley is one of the first domesticated cereals and has been grown for almost 10,000 years; archaeological evidence suggests that barley was grown as early as 8000 BC in Iran. The most limiting element for crop yield among fertiliser nutrients is nitrogen, which is also the one that is absorbed in the greatest quantity. Thus, it stimulates fruit and seed formation, boosts leaf size and quality, and causes rapid growth. While high nitrogen fertiliser rates can provide a sufficient amount of nitrogen to be translocated from vegetative organs to the grain, resulting in a high grain protein content, inadequate nitrogen can lower the quality below acceptable levels.

Barley accounts for almost 7% of the world's cereal production. With 42% of global barley production, the European Union-27 (EU-27) leads the pack, followed by Russia (15%), Ukraine (8%), Canada (8%), and Australia (5%). Barley is grown as a winter crop in India. It is harvested in March or April after being sowed in October or November. India has maintained a steady yearly production of 1.59 million metric tonnes in 2024, compared to 1781 and 1,633 thousand tonnes in 2023. At 0.7–0.8 lakh hectares, the area under cultivation has likewise stayed constant, yielding about 1,944 kg per hectare. In India, the states of Madhya Pradesh, Rajasthan, and Uttar Pradesh account for 34%, 30%, and 12% of total acreage, respectively, of barley cultivation. Approximately 80% of the total acreage is made up of these states combined. Rajasthan leads in output despite having the second-highest acreage, thanks to the state's high yield level. Rajasthan makes up 40% of the total, with Uttar Pradesh (31%), Madhya Pradesh (9%), and Haryana (6%), following closely behind. (2023, Anonymous). found that deep tillage greatly enhanced taramira seed output and efficiently preserved soil moisture during periods of intermittent drought. It is recommended that field bounding, deep ploughing during monsoon and straw mulching @ 5 t ha-1 may be followed for enhancement of taramira seed yield and water productivity through in-situ moisture conservation. Regar and associates (2009).

VAM are found in the majority of terrestrial ecosystems and are crucial to the composition and operation of communities. Their function in primary succession is still unclear, though. The function of VAM in Mount St. Helens pioneer species was investigated in two greenhouse trials under four competitive scenarios and three nutrient regimes. Since plants in the -P treatment often had higher levels of VAM colonisation and biomass than those in the full nutrition treatment, there was a slight but noticeable benefit from VAM in the -P treatment. Plants treated with full nutrients benefited more from VAM colonisation than those treated with tap water (Titus, Jonathan H. and del Moral, Roger, 1998). At the Instructional Farm, Department of Agronomy, College of Agriculture, Junagadh Agricultural University, and Junagadh, a field experiment titled "Yield maximisation through nutrient management in barley" was conducted during the 2021–22 rabi season. Ten nutrient management treatments were included in the experiment: 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 coated urea + 50% N from Zn coated urea + P from + P from SSP) were evaluated in randomized block design with three replications. Akhtar, Nosheen *et al.* (2018).

Materials and Methods

At Rama University's Agriculture Research Farm in Kanpur, Uttar Pradesh, a field experiment was carried out during the Rabi season of 2022–2023 and 2023–2024 on Gangatic alluvial soil with a pH of 7.6, light texture, and medium soil fertility. The Kanpur region receives about 850 mm of rain on average each year. Treatments under the study program include: 1) N1 100% RDF (60 kg N ha-1 + 30 kg P2O5 ha-1 + 30 kg K2O ha-1) with chemical fertiliser; 2) 75% RDF (with chemical fertiliser) + 25% FYM (farm yard manure); and 3) 50% RDF (with chemical fertiliser) + 50% FYM (farm yard manure); and 3) three moisture conservation techniques: 1) M1-Control; 2) M2-Dust mulch; and 3) M3-Pinoxaden 5.1 EC @ 50 g a.i ha-1 + VAM @ 15 kg ha-1).

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.

A. Preparatory tillage: (T)

1. One cross ploughing with cultivator
2. One ploughing with disc harrow + one cross ploughing with cultivator
3. One ploughing by disc harrow + one pass with rotavator

B. Nutrient managements: (N)

1. 100% RDF (60 Kg N + 30 Kg P + 30 Kg K /ha)
2. 75% RDF + 25% FYM
3. 50% RDF +50% FYM

C. Moisture conservation practices: (M)

1. Control,
2. Dust mulch
3. Pinoxaden 5EC @ 50 g/ha + VAM @ 15 Kg/ha

Results and Discussion:-

Growth parameters flowering (50%) and maturity after (DAS) of barley crop

The impact of nutrient management, moisture conservation techniques, and preparatory tillage on 50% flowering and maturity after (DAS) of barley crops was examined. Table 1 presents the outcomes of both years statistically.

Data showed unequivocally that Table 1's maximum day to flowering on preparatory tillage-T3 one disc harrow ploughing plus one rotavator pass, followed by treatment T2) one disc harrow ploughing plus one cultivator cross plough and However, the minimum day to flowering on the treatment-recorded preparatory tillageUnder nutrient management approaches, T1) one cross ploughing with cultivator, N3) 50% RDF + 50% FYM more days to blooming campier to N2) 75% RDF + 25% FYM and lowest day to flowering The highest day to flowering under moisture conservation methods, such as M3) pinoxaden 5EC @ 50 gha-1 + VAM @ 15 kg ha-1, followed by M2) dust mulch, is M1) 100% RDF (60 kg N + 30 kg P2O5 + 30 kg K2O ha-1), while the lowest day to flowering is M1) control.

It is evident from the results that the maximum day to maturity of barley was achieved in both years at the stages of the observations when the barley crop was sown in plots where T3) one ploughing with a disc harrow and one pass with a rotavator, application of nutrient management practices namely, N3) 50% RDF through chemical fertiliser + 50% FYM and moisture conservation practices of M3) pnoxaden 5EC @ 50g ha-1 + VAM @ 15 Kg ha-1, followed by T2) one disc harrowing and one cross ploughing with Under treatment T1, the minimum day to maturity for preparatory tillage was noted. one cross ploughing with cultivator, nutrient management practices N1) 100% RDF (60 Kg N + 30 Kg P2O5 + 30 Kg K2O ha-1) and moisture conservation practices M1) control during the two years study respectively.

Yield attributes of barley

The findings of a statistical analysis of the effects of moisture conservation techniques, nutrient management, and preparatory tillage on barley production parameters are shown in Table 2. While the minimum length of spike on preparatory tillage under recorded preparatory treatment T1) was one cross ploughing with cultivator, the preparation tillage practices of barley significantly produced spike length, i.e., T3) one ploughing with disc harrow + one pass with rotavator produced the largest ear than all ordered tested of preparatory tillage. demonstrates that, in contrast to earlier tests of preliminary tillage, the tillage treatment T3), which consisted of one ploughing with a disc harrow and one pass with a rotavator, produced the most grains per spike over the experimental year of study. During the two experimental years of the study, the minimum number of grains per spike was counted in the preparatory tillage treatment (T1) one cross ploughing with cultivator. The results were comparable to those of [Mohammad et al. (2012)]. [6]. In contrast to earlier preliminary tillage tests, the T3's maximum weight of spike (g) was achieved for the two years of study after one ploughing with a disc harrow and one rotavator pass. Weight in tillage had the lowest spike weight (g), meaning that The data clearly shows that, compared to another test of preparatory tillage, the T3) one ploughing with a disc harrow and one pass with a rotavator showed greater grain weight (g) plant-1 over both study years. During the experimental years, the minimum grain weight (g) plant-1 was weighted in tillage practices

T1) one cross ploughing with cultivator. The results showed that T3) one disc harrow ploughing plus one rotavator pass produced the highest grain weight (g) in both years, outperforming the other two studied methods (T2) one disc harrow ploughing plus one cross ploughing with a cultivator, During the two experimental years, the preparatory tillage T1 one cross ploughing with cultivator was used to weigh the minimum test weight (1000-grain weight (g)).

The longest spike length (8.08 & 8.26) of barley was produced by nutrient management practices at N3) 50% RDF (chemical fertilizer + 50% FYM (farm yard manure). During both years, the shortest spike length (7.16 & 7.32) of barley was recorded at N1) 100% RDF (60 Kg N ha-1 + 30 Kg P2O5 ha-1 + 30 Kg K2O ha-1) through chemical fertiliser. N3) 50% RDF (by chemical fertiliser) + 50% FYM (farm yard manure) yielded the highest number of grain spike-1 (36.06 & 36.79) of barley in both the 2022-23 and 2023–24 years. Nutrient management strategies during both years showed the lowest number of barley grain spikes-1 (35.05 & 36.02).

N3 treatments include 50% RDF (chemical fertiliser) and 50% FYM (farm yard manure) in nutrient management techniques. The nutrient management methods at N1) 100% RDF (60 Kg N ha-1 + 30 Kg P2O5 ha-1 + 30 Kg K2O ha-1) with chemical fertiliser resulted in noticeably higher weight of spike (g) (2.39 & 2.81) of barley and the lowest weight of spike (g) (2.93 & 3.19) of barley. 3) 50% FYM (farm yard manure) + 50% RDF (chemical fertiliser) notably higher barley grain weight (g)/plant (4.33 & 4.39) in 2023–2024, Reduced barley grain weight (g)/plant (4.03 & 4.05) was noted in the nutrition management procedures provided at N1). 50% RDF + 50% FYM and nutrient management practices, 3) 50% RDF (through chemical fertiliser) + 50% FYM (farm yard manure), and 100% RDF (60 kg N ha-1 + 30 kg P2O5 ha-1 + 30 kg K2O ha-1) through chemical fertiliser, with a maximum grain weight (g) of 1000 grains (35.85 & 36.27) of barley [Dinka and others, 2018] [5], of barley was noted in the N1 nutrient management procedures. In nutrient management methods, 100% RDF (60 kg N ha-1 + 30 kg P2O5 ha-1 + 30 kg K2O ha-1) was achieved mostly by chemical fertiliser in 2017–18 and 2018–19. Like {Dhiman, Shilva and Dubey, Y.P. (2017)}

Significantly, the maximum spike length (8.02 & 8.20) of barley was produced at T3) pinoxaden 5EC @ 50 a.i. g/ha + VAM @ 15 Kg/ha via moisture conservation practices, while the minimum spike length (7.19 & 7.45) of barley was recorded at M1) control during both years. During the years 2017–18 and 2018–19, the application of moisture conservation techniques at the various stages of barley in the experimental field resulted in a significant increase in the number of grain spikes per hectare of barley at T3) pinoxaden 5EC @ 50 a.i. g/ha. + VAM @ 15 Kg/ha.During 2023–2024, fewer barley grain spikes per year were observed in the control group using moisture conservation techniques. The weight of the barley spike (g) was significantly higher in moisture conservation practices T3) pinoxaden 5EC @ 50 g/ha. + VAM @ 15 Kg/ha than in M2) dust mulch during 2023–2024. The lowest weight (g) of the barley spike was recorded in moisture conservation practices at control during 2023–2024. The highest grain weight (g)/plant of barley during 2023–24 was recorded in moisture conservation practices given at control, and the lowest grain weight (g)/plant of barley was recorded in moisture conservation practices applied at the various stages of barley in experimental field effect during 2023–24. T3) pinoxaden 5EC @ 50 a.i. g/ha. + VAM @ 15 Kg/ha. In the experimental field impact during 2023-24, the maximum weight (g) of barley grains was recorded in T3) pinoxaden 5EC @ 50 a.i. g/ha + VAM @ 15 Kg/ha in moisture conservation methods at the various stages of barley.

Summery and Conclusion

The data of the preparatory tillage operation of barley given at T3) was collected during the Rabi season. One ploughing with a disc harrow and one pass with a rotavator increased the number of days to flowering (82.47 & 82.48) and maturity (126.34 & 127.00) of barley compared to the first and second years. At T1, one cross ploughing with a cultivator throughout the two years of 2023–2024 produced the minimum number of days required for barley to flower (79.49 & 80.44) and mature (123.69 & 124.80).

In both 2022-23 and 2023–24, barley produced the highest yield attribute correctors, including spike length (8.04 and 8.35 cm), number of grain spike-1 (36.26 and 36.96), spike weight (g) (3.06 & 3.19), grain weight (g)/plant (4.27 and 4.30), and 1000 grain weight (g) (35.92 and 36.37), at the preparatory tillage operation (T3), which involved one ploughing with a disc harrow and one pass with a rotavator. In the preparatory tillage operation conducted at T1, one cross ploughing with cultivator during both years, the minimum spike length (7.19 and 7.37), number of grain spike-1 (34.91 & 35.72), spike weight (g) (2.34 & 2.83), grain weight (g)/plant (4.13 & 4.16), and lowest 1000 grain weight (g) (34.97 and 35.44) of barley were recorded. As camper to **Baigys, G.; Feiza, V.; Kutra, G. and Feiziene, D. (2006**).

The highest yield attribute correctors, or nutrient management techniques for barley provided at N3)50% RDF +50% FYM, were significantly created. Compared to the first to the second year, it took more days for barley to reach all phases of maturity (126.14 & 126.89) and flowering (82.34 & 93.56). In both the 2022-23 and 2023–24 years, the nutrient management strategies gave at N1) 100% RDF (60 Kg N + 30 Kg P + 30 Kg K /ha) prescribed dose using chemical fertiliser resulted in the minimum number of days needed for barley to blossom (79.75 & 80.56) and mature (124.14 & 125.06). Comparable to Suri, V. K.; Datt, N.; and Sharma, R. P. (2001).

In 2023–2024, barley that was at N3) 50% RDF (dose through chemical fertiliser) +50% FYM produced significantly more spike length (8.08 and 8.26 cm), number of grain spike-1 (36.06 and 36.79), spike weight (g) (2.93 and 3.19), grain weight (g)/plant (4.33 & 4.39), and maximum 1000 grains weight (g) (35.85 & 36.27).Reduced spike length (7.16 and 7.32), number of grain spike-1 (35.05 & 36.02), spike weight (g) (2.39 & 2.81), grain weight (g)/plant (4.03 & 4.05), and minimum 1000 grain weight (g) (34.86 & 35.49) of barley were noted in nutrient management practices provided at N1) 100% RDF (60 Kg N + 30 Kg P + 30 Kg K /ha) recommended dose through chemical fertiliser during boththe year. Barley's moisture conservation methods at T3) pinoxaden 5EC @ 50 g/ha. + VAM @ 15 kg/ha. lengthened the time it took for the plant to blossom (82.05 and 82.97) and mature (125.98 and 126.75) at every stage of the crop compared to the first to second year. Using moisture conservation techniques, barley reached a minimum number of days needed for flowering (80.07 & 81.02) and maturity (124.41 & 125.11) in both 2023 and 2024.

In both 2022-23 and 2023–24, the maximum yield attributes and yield—namely, spike length (cm) (8.02 and 8.20), number of grain spike-1 (36.03 and 36.74), spike weight (g) (2.91 & 3.18), grain weight (g)/plant (4.40 & 4.46), and 1000 grains weight (g) (35.89 & 36.33)—were produced by the significant use of moisture conservation practices for barley. This was at T3) pinoxaden 5EC @ 50 g/ha. + VAM @ 15 Kg/ha. During both years, the following moisture conservation practices were recorded: minimum spike length (cm) (7.19 & 7.45), number of grain spike-1 (35.21 & 35.85), spike weight (g) (2.45 & 2.80), grain weight (g)/plant (3.92 & 3.95), and 1000 grain weight (g) (34.88 & 35.47) of barley. Use of moisture-saving techniques in the experimental field during various barley stages.

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Table1: Effect of preparatory tillage, Nutrient managements and moisture conservation practices on 50% Flowering days, Days of maturity of barley

Treatments	50%Floweringdays		Daysof maturity	
	2022-23	2023-24	2022-23	2023-24
PreparatoryTillage(T)				
T1- One cross ploughing with cultivator	79.49	80.44	123.69	124.80
T2- One ploughing with disc harrow + one cross ploughing with cultivator	81.27	82.15	125.65	126.00
T3- One ploughing by disc harrow +one pass with rotavato	82.47	82.48	126.34	127.00
SE (d)	0.27	0.31	0.16	0.32
CD (P=0.05)	0.58	0.66	0.34	0.69
NutrientManagement(N)				
N1-100% RDF	79.75	80.56	124.14	125.06
N2-75% RDF+ 25% FYM	81.13	81.95	125.41	125.85
N3-75% RDF+ 25% FYM	82.34	93.56	126.14	126.89
SE (d)	0.27	0.31	0.16	0.32
CD (P=0.05)	0.58	0.66	0.34	0.69
MoistureConservationPractices(M)				
M1–Control	80.07	81.02	124.41	125.11
M2-Dust mulch	81.09	82.07	125.29	125.94
M3- Pinoxaden5EC @ 50g/ha+ VAM @ 15 Kg/ha	82.05	82.97	125.98	126.75
SE (d)	0.29	0.30	0.36	0.33

CD (P=0.05)	0.59	0.61	0.73	0.67

Table2: Effect of Preparatory tillage, Nutrient managements and Moisture conservation practices on yield attributes and yield of barley

Treatments	Length of spike		Numberofg rain/ spike		Weightofs pike (g)		Grainweigh t(g)/ plant		1000gr ains weight (g)	
	2022-23	2023-24	2022-23	2023-24	2022-23	2023-24	2022-23	2023-24	2022-23	2023-24
PreparatoryTillage(T)										
T1- One cross ploughing with cultivator	7.19	7.37	34.91	35.72	2.34	2.83	4.13	4.16	34.97	35.44
T2- One ploughing with disc harrow + one cross ploughing with cultivator	7.51	7.71	35.56	36.28	2.59	2.94	4.15	4.20	35.41	35.89
T3- One ploughing by disc harrow +one pass with rotavato	8.04	8.35	36.26	36.96	3.06	3.19	4.27	4.30	35.92	36.37
SE (d)	0.06	0.12	0.28	0.30	0.07	0.11	0.09	0.07	0.26	0.27
CD (P=0.05)	0.13	0.26	0.59	0.64	0.15	0.24	N.S.	N.S.	0.55	0.57
NutrientManagement(N)										
N1 -100% RDF	7.16	7.32	35.05	36.02	2.39	2.81	4.03	4.05	34.86	35.49
N2-75% RDF+ 25% FYM	7.50	7.84	35.62	36.15	2.66	2.97	4.19	4.22	35.58	35.94
N3-75% RDF+ 25% FYM	8.08	8.26	36.06	36.79	2.93	3.19	4.33	4.39	35.85	36.27
SE (d)	0.06	0.12	0.28	0.30	0.07	0.11	0.09	0.07	0.26	0.27
CD (P=0.05)	0.13	0.26	0.59	0.64	0.15	0.24	0.10	0.15	0.55	0.57
MoistureConservationPractices(M)										
M1–Control	7.19	7.45	35.21	35.85	2.45	2.80	3.92	3.95	34.88	35.47

M2-Dust mulch	7.53	7.77	35.50	36.37	2.63	2.98	4.23	4.25	35.53	35.91
M3- Pinoxaden5EC@50g/ha+VAM@15 Kg/ha	8.02	8.20	36.03	36.74	2.91	3.18	4.40	4.46	35.89	36.33
SE (d)	0.06	0.11	0.29	0.30	0.08	0.09	0.09	0.10	0.28	0.30
CD (P=0.05)	0.13	0.24	0.58	0.61	0.17	0.19	0.18	0.21	0.57	0.61