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Effect of preparatory tillage, nutrient managements and moisture conservation practices as response on growth parameters and yield attributes of barley cultivation under water stress condition

Raghvendra Singh, Sarvesh Kumar, Pradeep Kumar, Raj Kumar and Ranjeet Kumar

Abstract
A field experiment were conducted for two consecutive rabi seasons during 2017-18 and 2018-19 at soil conservation and water management farm, C.S. Azad University of Agriculture and Technology Kanpur on gangatic alluvial soil having 7.6 pH, light textured soil with medium soil fertility. Treatments comprises of *viz*., three preparatory tillage T_1 - one cross ploughing with cultivator, T_2 - one ploughing with disc harrow + one cross ploughing with cultivator and T_3- one ploughing with disc harrow + one pass with rotavator, three nutrient management practices i.e. N_1-100% RDF (60 Kg N ha^{-1} + 30 Kg P_2O_5 ha^{-1}+ 30 Kg K_2O ha^{-1}) through chemical fertilizer, N_2-75% RDF(through chemical fertilizer) + 25% FYM (Farm yard manure) and N_3-50% RDF (through chemical fertilizer) +50% FYM (Farm yard manure) and three moisture conservation practices *viz*., 1) M_1- Control, 2) M_2 - Dust mulch and 3) M_3- Pinoxaden 5.1 EC @ 50 g a.i 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, T_3- one ploughing with disc harrow + one pass with rotavator, nutrient applied as N_3-50% RDF through chemical fertilizer + 50% FYM and moisture conservation practices of M_3-pinoxaden 5EC @ 50 g/ha. + VAM @ 15 Kg/ha brought out the maximum values of growth parameters, yield attributes and day of flowering and day of maturity of barley observed during both the years of study respectively followed by T_1 - one cross ploughing with cultivator, N_1-100% RDF (60 Kg N ha^{-1} + 30 Kg P_2O_5 ha^{-1}+ 30 Kg K_2O ha^{-1}) through chemical fertilizer and moisture conservation practices of M_2-dust mulch.

Keywords: preparatory tillage- T_1- one cross ploughing with cultivator, T_2- one ploughing with disc harrow + one cross ploughing with cultivator, T_3- one ploughing by disc harrow + one pass with rotavator, nutrient management practices- N_1-100% RDF (60 Kg N ha^{-1} + 30 Kg P_2O_5 ha^{-1}+ 30 Kg K_2O ha^{-1}), N_2-75% RDF + 25% FYM (Farm yard manure), N_3-50% RDF +50% FYM (Farm yard manure)

Introduction
Barley 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, A. 2005) [9].

It is also known to contain water soluble fiber (beta glucans) and oil compound (tocotrienols) which are found to be effective in lowering cholesterol level of blood. Barley straw is also used for making silage and hay. Its grains contain 8-10 per cent protein and 74 per cent carbohydrates besides minerals and vitamin B-complex, this is a forms of staple food, cattle feed, malt for manufacturing of beer and other liquor products. It is one of the first cereals to have been domesticated, have been cultivated for more than 10000 years, with archaeological evidence of barley cultivation in Iran as long ago as 8000 BC. Among the fertilizer nutrients, nitrogen is the nutrient that is absorbed in largest amount and is the most limiting factor for crop production. 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.

In the world, barley has share of 7% of the global cereals production. European Union-27 (EU-27) is the largest producer of barley in the world with a contribution of 42% followed by Russia (15%), Ukraine (8%), Canada (8%) and Australia (5%). In India, barley is cultivated as a winter crop. It is sown during October-November and harvested from March to April. India's annual production has been stable at 1.59 million metric tonnes in recent year during 2020, and 2019 it was 1781 and 1,633 thousand tonnes. The area under cultivation has also remained stagnant at 0.7-0.8 lakh hectares, 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 acreage. Together, these states account for about 80% of the total acreage. Although Rajasthan ranks second in terms of acreage, it tops in terms of production, due to good yield level in the state. Rajasthan accounts for 40% of total production followed by Uttar Pradesh (31%), Madhya Pradesh (9%) and Haryana (6%). (Anonymous, 2020) [2], investigated that the deep tillage during intermittent drought period effectively conserved the soil moisture and significantly increased the seed yield of *taramira*. 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, *et al.* (2009) [7].

VAM are present in most terrestrial ecosystems and play a major role in community structure and function. However, their role in primary succession remains poorly understood. Two greenhouse studies examined the role of VAM in Mount St. Helens pioneer species under three nutrient regimes and four competitive scenarios. A weak but apparent benefit from VAM occurred in the - P treatment since plants in the -P treatment were usually not less in biomass than those in the complete nutrient treatment and VAM colonization levels were greater in the -P treatment. 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 entitled "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 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) [1].

Materials and Methods

A field experiment was conducted during *Rabi* season of 2017-18 and 2018-19 at Soil Conservation and Water Management Farm of the *Chandra Shekhar Azad University of Agriculture and Technology*, Kanpur UP., on gangatic alluvial soil having 7.6 Ph, light textured soil with medium soil fertility. In Kanpur region average rainfall is approximately 850mm annually. Under the study programme treatments comprises of *viz*., three nutrient management practices i.e. N_1 100% RDF (60 Kg N ha^{-1} + 30 Kg P_2O_5 ha^{-1}+ 30 Kg K_2O ha^{-1}) through chemical fertilizer, N_2- 75% RDF(through chemical fertilizer) + 25% FYM (Farm yard manure) and N_3- 50% RDF (through chemical fertilizer) +50% FYM (Farm yard manure) and three moisture conservation practices *viz*., 1) M_1- Control, 2) M_2 - Dust mulch and 3) M_3 - 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

Effect of Preparatory tillage, Nutrient managements and Moisture conservation practices on 50% flowering and maturity after (DAS) of barley crop were analysed statistically the results of both years have been presented in Table-1.

Data clearly indicated that Table-1 maximum day to flowering on preparatory tillage- T_3 one ploughing with disc harrow + one pass with rotavator, followed by treatment T_2) one ploughing with disk harrow + one cross ploughing with cultivator and While minimum day to flowering on preparatory tillage recorded under treatment T_1) one cross ploughing with cultivator, under nutrient management practices i.e., N_3) 50% RDF +50% FYM more day to flowering campier to N_2) 75% RDF + 25% FYM and lowest day to flowering under nutrient management practices N_1) 100% RDF (60 Kg N + 30 Kg P_2O_5 + 30 Kg K_2O ha^{-1}), and highest day to flowering under moisture conservation practices i.e., M_3) pinoxaden 5EC @ 50 gha^{-1} + VAM @ 15 Kg ha^{-1} followed by M_2) dust mulch and lowest day to flowering is M_1) control.

Table 1: Effect of preparatory tillage, Nutrient managements and moisture conservation practices on 50% Flowering days, Days of maturity of barley

Treatments	50% Flowering days		Days of maturity	
	2017-18	2018-19	2017-18	2018-19
Preparatory Tillage (T)				
T_1 - One cross ploughing with cultivator	79.49	80.44	123.69	124.80
T_2 - One ploughing with disc harrow + one cross ploughing with cultivator	81.27	82.15	125.65	126.00
T_3 - 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
Nutrient Management (N)				
N_1 - 100% RDF	79.75	80.56	124.14	125.06
N_2 - 75% RDF + 25% FYM	81.13	81.95	125.41	125.85
N_3 - 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
Moisture Conservation Practices (M)				
M_1 – Control	80.07	81.02	124.41	125.11
M_2 - Dust mulch	81.09	82.07	125.29	125.94
M_3 - Pinoxaden 5EC @ 50 g/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

The day to maturity is clear from the results that sowing of the barley crop in plots where, T_3) one ploughing with disc harrow + one pass with rotavator, application of nutrient management practices *viz*., N_3) 50% RDF through chemical fertilizer + 50% FYM and moisture conservation practices of M_3) pnoxaden 5EC @ 50g ha^{-1} + VAM @ 15 Kg ha^{-1} brought out the maximum day to maturity of barley in both the years respectively at stages of the observations, followed by T_2) one ploughing with disk harrow + one cross ploughing with cultivator, N_2) 75% RDF (through chemical fertilizer) + 25% FYM (farm yard manure) and moisture conservation practices of M_2) dust mulch at the both year of study. While minimum day to maturity on preparatory tillage recorded under treatment T_1) one cross ploughing with cultivator, nutrient management practices N_1) 100% RDF (60 Kg N + 30 Kg P_2O_5 + 30 Kg K_2O ha^{-1}) and moisture conservation practices M_1) control during the two years study respectively.

Yield attributes of barley

Effect of Preparatory tillage, Nutrient managements and Moisture conservation practices on yield attributes of barley were analyzed statistically the results of both years have been presented in Table- 2.

Preparatory tillage practices of barley significantly produced length of spike, i.e., T_3) one ploughing with disc harrow + one pass with rotavator produced the largest ear than all order tested of preparatory tillage, While minimum length of spike on preparatory tillage under recorded preparatory treatment T_1) one cross ploughing with cultivator. The observed data makes it clear that the tillage treatment T_3) one ploughing with disc harrow + one pass with rotavator, displayed the maximum number of grains per spike during the experimental year of study in comparison to other tests of preparatory tillage, The minimum number of grains per spike was counted treatment in preparatory tillage i.e., T_1) one cross ploughing with cultivator, during both the years of study results of two experimental years as similar to [Mohammad, *et al.* (2012)] [6]. Maximum weight of spike (g) clear that the T_3) one ploughing with disc harrow + one pass with rotavator in under preparatory tillage, during the two years of study in comparison to other tested of preparatory tillage, The lowest weight of spike (g) was weight in tillage i.e., T_1) one cross ploughing with cultivator, during 2017-18 & 2018-19.The data makes is clear that the T_3) one ploughing with disc harrow + one pass with rotavator, show more grain weight (g) $plant^{-1}$ during both year of study in comparison to another test of preparatory tillage. The minimum grain weight (g) $plant^{-1}$ was weighted in tillage practices T_1) one cross ploughing with cultivator, during experimental years. The consequence displayed that T_3) one ploughing with disc harrow + one pass with rotavator, brought out the maximum 1000-grain weight (g) in both years, where this was found superior to other two tested practices i.e., T_2) one ploughing with disc harrow + one cross ploughing with cultivator, The minimum test weight (1000-grain weight (g)) was weighed in preparatory tillage T_1) one cross ploughing with cultivator during two experimental years.

Table 2: Effect of Preparatory tillage, Nutrient managements and Moisture conservation practices on yield attributes and yield of barley

Treatments	Length of spike		Number of grain/ spike		Weight of spike (g)		Grain weight (g)/ plant		1000 grains weight (g)	
	2017-18	2018-19	2017-18	2018-19	2017-18	2018-19	2017-18	2018-19	2017-18	2018-19
Preparatory Tillage (T)										
T_1 - 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
T_2 - 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
T_3 - 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
Nutrient Management (N)										

N_1 - 100% RDF	7.16	7.32	35.05	36.02	2.39	2.81	4.03	4.05	34.86	35.49
N_2 - 75% RDF + 25% FYM	7.50	7.84	35.62	36.15	2.66	2.97	4.19	4.22	35.58	35.94
N_3 - 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
Moisture Conservation Practices (M)										
M_1 – Control	7.19	7.45	35.21	35.85	2.45	2.80	3.92	3.95	34.88	35.47
M_2 - Dust mulch	7.53	7.77	35.50	36.37	2.63	2.98	4.23	4.25	35.53	35.91
M_3 - Pinoxaden 5EC @ 50 g/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

Nutrient managements practices of barley significantly produced maximum length of spike (8.08 & 8.26) of barley which was at N_3) 50% RDF (through chemical fertilizer) +50% FYM (Farm yard manure), lesser length of spike (7.16 & 7.32) of barley was recorded in nutrient managements practices given at N_1) 100% RDF (60 Kg N ha^{-1} + 30 Kg P_2O_5 ha^{-1}+ 30 Kg K_2O ha^{-1}) through chemical fertilizer during both the year. Significantly produced highest number of grain $spike^{-1}$ (36.06 & 36.79) of barley which was at, N_3) 50% RDF (through chemical fertilizer) +50% FYM (Farm yard manure) during both the year of 2017-18 & 2018-19.lowest number of grain $spike^{-1}$ (35.05 & 36.02) of barley was recorded in nutrient managements practices given at N_1) 100% RDF (60 Kg N ha^{-1} + 30 Kg P_2O_5 ha^{-1}+ 30 Kg K_2O ha^{-1}) through chemical fertilizer during both the year.

In nutrient managements practices, treatments N_3 - 50% RDF (through chemical fertilizer) +50% FYM (Farm yard manure) significantly more weight of spike (g) (2.39 & 2.81), of barley and lowest weight of spike (g) (2.93 & 3.19) of barley was recorded in nutrient managements practices given at N_1) 100% RDF (60 Kg N ha^{-1} + 30 Kg P_2O_5 ha^{-1}+ 30 Kg K_2O ha^{-1}) through chemical fertilizer, nutrient managements practices, 3) 50% RDF (through chemical fertilizer) +50% FYM (Farm yard manure) significantly more grain weight (g)/ plant (4.33 & 4.39) of barley during 2017-18 and 2018-19, less grain weight (g)/ plant (4.03 & 4.05) of barley was recorded in nutrient managements practices given at N_1) 100% RDF (60 Kg N ha^{-1} + 30 Kg P_2O_5 ha^{-1}+ 30 Kg K_2O ha^{-1}) through chemical fertilizer, maximum 1000 grains weight (g) (35.85 & 36.27) of barley, was recorded in 50% RDF +50% FYM and nutrient managements practices, 3) 50% RDF (through chemical fertilizer) +50% FYM (Farm yard manure) [Dinka, *et al.* (2018)] [5], of barley was recorded in nutrient managements practices given at N_1) 100% RDF (60 Kg N ha^{-1} + 30 Kg P_2O_5 ha^{-1}+ 30 Kg K_2O ha^{-1}) through chemical fertilizer in nutrient managements practices significantly during 2017-18 and 2018-19. As similar that {Dhiman, Shilva and Dubey, Y.P. (2017)} [4].

Significantly use of moisture conservation practices of barley produced maximum length of spike (8.02 & 8.20) of barley which was at T_3) pinoxaden 5EC @ 50 *a.i.* g/ha + VAM @ 15 Kg/ha, minimum length of spike (7.19 & 7.45), of barley was recorded in moisture conservation practices given at, M_1) control during both the year. Application of moisture conservation practices at the different stages of barley in experimental field, the effect on yield attributes of barley significantly produced more number of grain $spike^{-1}$ of barley which was at T_3) pinoxaden 5EC @ 50 *a.i.* g/ha. + VAM @ 15 Kg/ha during both the year of 2017-18 & 2018-19.less number of grain $spike^{-1}$ of barley was recorded in moisture conservation practices given at control during 2017-18 & 2018-19. In moisture conservation practices T_3) pinoxaden 5EC @ 50 g/ha. + VAM @ 15 Kg/ha significantly supreme weight of spike (g) of barley as compared to M_2) dust mulch during 2017-18 and 2018-19, minimal weight (g) of spike of barley was recorded in moisture conservation practices was given at control during 2017-18 & 2018-19. Moisture conservation practices, T_3) pinoxaden 5EC @ 50 *a.i.* g/ha. + VAM @ 15 Kg/ha significantly highest grain weight (g)/ plant of barley during 2017-18 and 2018-19, lowest grain weight (g)/ plant of barley was recorded in moisture conservation practices given at control and application of moisture conservation practices at the different stages of barley in experimental field effect on during 2017-18 & 2018-19. Maximum 1000 grains weight (g) of barley, was recorded in T_3) pinoxaden 5EC @ 50 *a.i.* g/ha. + VAM @ 15 Kg/ha in moisture conservation practices at the different stages of barley in experimental field effect on during 2017-18 & 2018-19.

Summery and Conclusion

A field experiment was conducted during the *rabi* season of the data of preparatory tillage operation of barley given at T_3) one ploughing with disc harrow + one pass with rotavator increased number of days taken for days to flowering (82.47 & 82.48) and maturity (126.34 & 127.00) of barley as compared to I^{st} year to II^{nd} year. Minimum number of days taken for days to flowering (79.49 & 80.44) and maturity (123.69 and 124.80) of barley was obtained in preparatory tillage operation given at T_1) one cross ploughing with cultivator during both the year of 2017-18 & 2018-19.

Barley significantly produced highest yield attribute correctors i.e., length of spike (8.04 and 8.35cm), number of grain $spike^{-1}$ (36.26 and 36.96), weight of spike (g) (3.06 & 3.19), grain weight (g)/ plant (4.27 and 4.30) and 1000 grains weight (g) (35.92 and 36.37) of barley which was at preparatory tillage operation- T_3) one ploughing with disc harrow + one pass with rotavator during both the year of 2017-18 & 2018-19. While minimum length of spike (7.19 and 7.37), number of grain $spike^{-1}$ (34.91 & 35.72), weight of spike (g) (2.34 & 2.83), grain weight (g)/ plant (4.13 & 4.16) and lowest 1000 grains weight (g) (34.97 and 35.44) of barley was recorded in preparatory tillage operation given at T_1) one cross ploughing with cultivator during both the year. As camper to Baigys, G.; Feiza, V.; Kutra, G. and Feiziene, D. (2006) [3].

Significantly produced highest yield attribute correctors i.e., nutrient managements practices of barley given at N_3)50% RDF +50% FYM increased number of days taken for day to flowering (82.34 & 93.56) and maturity (126.14 & 126.89) at all stages of barley as compared to I^{st} year to II^{nd} year. Minimum number of days taken for day to flowering (79.75 & 80.56) and maturity (124.14 & 125.06) of barley was obtained in nutrient managements practices given at N_1) 100% RDF (60 Kg N + 30 Kg P + 30 Kg K /ha) recommended dose through chemical fertilizer during both

the year of 2017-18 & 2018-19. As similar to Sharma, R. P.; Suri, V. K; and Datt, N. (2001) [8].

Nutrient managements practices of barley significantly produced more length of spike (8.08 and 8.26 cm), number of grain spike^{-1} (36.06 and 36.79), weight of spike (g) (2.93 and 3.19), grain weight (g)/ plant (4.33 & 4.39) and maximum 1000 grains weight (g) (35.85 & 36.27) of barley which was at N_3) 50% RDF (dose through chemical fertilizer) +50% FYM during both the year of 2017-18 & 2018-19.lesser length of spike (7.16 and 7.32), number of grain spike^{-1} (35.05 & 36.02), weight of spike (g) (2.39 & 2.81), grain weight (g)/ plant (4.03 & 4.05) and minimum 1000 grains weight (g) (34.86 & 35.49) of barley was recorded in nutrient managements practices given at N_1) 100% RDF (60 Kg N + 30 Kg P + 30 Kg K /ha) recommended dose through chemical fertilizer during both the year. Moisture conservation practices of barley given at T_3) pinoxaden 5EC @ 50. g/ha. + VAM @ 15 Kg/ha increased number of days taken for day to flowering (82.05 and 82.97)and maturity (125.98 and 126.75) at all stages of barley as compared to Ist year to IInd year. Minimum number of days taken for day to flowering (80.07 & 81.02) and maturity (124.41 & 125.11) of barley was obtained in moisture conservation practices given at control during both the year of 2017-18 & 2018-19.

Significantly use of moisture conservation practices of barley produced maximum yield attribute and yield *viz*., length of spike (cm) (8.02 and 8.20), number of grain spike^{-1} (36.03 and 36.74), weight of spike (g) (2.91 & 3.18), grain weight (g)/ plant (4.40 & 4.46) and 1000 grains weight (g) (35.89 & 36.33) of barley which was at T_3) pinoxaden 5EC @ 50 g/ha. + VAM @ 15 Kg/ha during both the year of 2017-18 & 2018-19. Minimum length of spike(cm) (7.19 & 7.45), number of grain spike^{-1} (35.21 and 35.85), weight of spike (g) (2.45 and 2.80), grain weight (g)/ plant (3.92 &3.95) and 1000 grains weight (g) (34.88 & 35.47) of barley was recorded in moisture conservation practices given at, M_1) control during both the year. Application of moisture conservation practices at the different stages of barley in experimental field.

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