Studies 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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A B S T R A C T

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- 200 802 on Gangetic 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 researched. 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⁻¹ + VAM @ 15 Kg ha⁻¹) 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 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 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 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 binding, 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. 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.

Recorded highest content of soil moisture at the depths from 10 to 30 cm, in the zone of crop roots. As the consequence, favorable conditions for crop growth and yields were observed. Deep tillage of soil had positive effects on homogenous distribution of soil moisture along the vertical profile, independent of the crop type (Tapanarova, 2005), 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. 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 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 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 800-850mm annually. Under the study programme treatments comprises of viz., 3.) 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. 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).

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
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 \( T_3 \) one ploughing with disc harrow + one cross ploughing with rotavator, followed by \( T_2 \) 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 \( T_1 \) one cross ploughing with cultivator during both year. As similar to Morell \textit{et al.}, (2011), Bajwa \textit{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 \( N_3 \) 50% recommended dose of fertilizer of ploughed with 50% farm yard manure (FYM) followed by application of \( N_1 \) 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 \( N_1 - 100\% \) 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 \( M_3 \) pinoxaden 5EC @ 50 g ha\(^{-1}\) + VAM @ 15 Kg ha\(^{-1}\) followed by \( M_2 \) 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 \( M_1 \) control during both the year of experimentation respectively.

Fresh 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- \( T_3 \) one ploughing with disc harrow + one pass with rotavator, application of nutrient- \( N_1 \) 50% RDF +50% FYM and moisture conservation practices- \( M_3 \) 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 \( T_1 \) one cross ploughing with cultivator, nutrient management \( N_1 \)100% RDF (60 Kg N + 30 Kg P\(_2\)O\(_5\) + 30 Kg K\(_2\)O ha\(^{-1}\)) and moisture conservation practices \( M_1 \) 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.

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

| Treatments | Grain Yield 2017-18 | Grain Yield 2018-19 | Straw Yield 2017-18 | Straw Yield 2018-19 | Biological Yield 2017-18 | Biological Yield 2018-19 |
|------------|---------------------|---------------------|---------------------|---------------------|--------------------------|--------------------------|
| Preparatory Tillage (T) | | | | | | |
| T1 - One cross ploughing with cultivator | 25.25 | 25.86 | 32.56 | 32.15 | 57.60 | 57.01 |
| T2 - One ploughing with disc harrow + one cross ploughing with cultivator | 25.74 | 27.17 | 34.25 | 35.96 | 59.91 | 63.23 |
| T3 - One ploughing by disc harrow + one pass with rotavator | 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 |
| Nutrient Management (N) | | | | | | |
| N1 - 100% RDF | 24.39 | 25.21 | 31.78 | 32.09 | 56.19 | 57.30 |
| N2 - 75% RDF + 25% FYM | 25.98 | 26.66 | 34.86 | 35.23 | 60.15 | 62.90 |
| N3 - 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 |
| Moisture Conservation Practices (M) | | | | | | |
| M1 – Control | 23.66 | 25.64 | 30.90 | 32.63 | 54.47 | 58.28 |
| M2 - Dust mulch | 26.26 | 26.79 | 34.68 | 35.36 | 59.96 | 62.16 |
| M3 - Pinoxaden 5EC @ 50 g/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 |
Table.2 Effect of tillage preparatory, nutrient managements and moisture conservation practices on fresh weight (g) / plant of barley

| Treatments                                                                 | 60DAS  | 90DAS  | AT MATURITY DAS  |
|---------------------------------------------------------------------------|--------|--------|------------------|
|                                                                           | 2017-18 | 2018-19 | 2017-18 | 2018-19 | 2017-18 | 2018-19 |
| **Preparatory Tillage (T)**                                               |        |        |        |
| T<sub>1</sub> - One cross ploughing with cultivator                       | 108.97 | 116.83 | 149.42 | 158.02 | 26.03   | 27.94   |
| T<sub>2</sub> - One ploughing with disc harrow + one cross ploughing with cultivator | 110.80 | 118.47 | 149.64 | 160.02 | 26.45   | 28.29   |
| T<sub>3</sub> - One ploughing by disc 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    |
| **Nutrient Management (N)**                                               |        |        |        |
| N<sub>1</sub> - 100% RDF                                                  | 105.07 | 112.70 | 144.12 | 152.22 | 25.10   | 26.91   |
| N<sub>2</sub> - 75% RDF + 25% FYM                                        | 111.94 | 119.84 | 151.20 | 161.86 | 26.73   | 28.55   |
| N<sub>3</sub> - 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    |
| **Moisture Conservation Practices (M)**                                   |        |        |        |
| M<sub>1</sub> – Control                                                  | 101.88 | 109.42 | 137.62 | 148.02 | 24.32   | 26.17   |
| M<sub>2</sub> - Dust mulch                                               | 113.15 | 121.48 | 155.04 | 164.08 | 27.02   | 28.95   |
| M<sub>3</sub> - Pinoxaden 5EC @ 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 | Preparatory Tillage (T) | Nutrient Management (N) | Moisture Conservation Practices (M) |
|------------|-------------------------|-------------------------|-------------------------------------|
|            | 60DAS | 90DAS | AT MATURITY DAS | 60DAS | 90DAS | AT MATURITY DAS | 60DAS | 90DAS | AT MATURITY DAS |
|            | 2017-18 | 2018-19 | 2017-18 | 2018-19 | 2017-18 | 2018-19 | 2017-18 | 2018-19 | 2017-18 | 2018-19 |
| T1 - One cross ploughing with cultivator | 8.41 | 8.59 | 16.31 | 16.74 | 18.28 | 18.75 |
| T2 - One ploughing with disc harrow + one cross ploughing with cultivator | 8.52 | 8.73 | 16.30 | 16.96 | 18.27 | 18.97 |
| T3 - One ploughing by disc harrow + one pass with rotavator | 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 |
| N1 - 100% RDF | 8.09 | 8.27 | 15.68 | 16.11 | 17.57 | 18.05 |
| N2 - 75% RDF + 25% FYM | 8.63 | 8.84 | 16.75 | 17.15 | 18.77 | 19.22 |
| N3 - 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 |
| M1 - Control | 7.87 | 8.04 | 15.26 | 15.67 | 17.10 | 17.56 |
| M2 - Dust mulch | 8.71 | 8.96 | 16.66 | 17.38 | 18.66 | 19.47 |
| M3 - Pinoxaden 5EC @ 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 T3) one ploughing with disc harrow + one pass with rotavator followed by T2) 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) and biological yield (62.34 & 66.60 q/ha). Minimum grain yield, straw yield and biological yield of barley was recorded in moisture conservation practices given at M1) control (23.66 & 25.64 q/ha), (30.90 & 32.63) and (54.74 & 58.28 q/ha) with cultivator during 2017-18 & 2018-19 respectively (Dinka et al., 2018).

Preparatory tillage operation of barley given at T3) one ploughing with disc harrow + one pass with rotavator, followed by practices T2) 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 T1) one cross ploughing with cultivator.

Under nutrient managements practices of barley given at N3) 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.

Minimum fresh and dry weight plant\(^1\) of barley was obtained under nutrient managements practices given at N1) 100% RDF during both the year of 2017-18 & 2018-19 respectively, and to conduct experiment was use of moisture conservation practices of barley given at T3) 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 of barley during both year, minutest fresh and dry weight plant\(^1\) of barley was obtained in moisture conservation practices given at M3) control during 2017-18 and 2018-19. As such as of Mohammad et al., (2012).
Acknowledgement

The authors acknowledging major advisor, Dr. Sarvesh Kumar, Professor and also the authors are thankful to the junior Mr. Pradeep Kumar, Department for providing the required research facilities. Department of Soil Conservation & Water Management, C. S. Azad University of Agriculture & Technology, Kanpur,(U.P.) India 200 802 for his keen interest, valuable guidance, and constructive criticism throughout the pursuit of the present research and vital suggestion during preparation of this manuscript.

References

Akhtar, Nosheen; Ramani, V. B.; Yunus, M. and Femi, Vala (2018) Effect of Different Nutrient Management Treatments on Growth, Yield Attributes, Yield and Quality of Wheat (Triticum aestivum L.), International Journal of Current Microbiology and Applied Sciences 7: 3473–3479.

Anonymous, (2020) Agricultural Statistics at a glance Department of Agriculture and Cooperation, Ministry of Agriculture, Govt. of India, New Delhi.

Baigys, G.; Feiza, V.; Kutra, G. and Feiziene, D. (2006) to the Physical soil properties and moisture impact on productivity of spring barley and peas after application of different tillage. Water Management Engineering, 3(6):23–31.

Bajwa, J.S.; Brar, S.S. and Kumar, S. (2002). Effect of different tillage systems on grain yield and energetics of wheat sown after rice. Extended Summaries Vol.2: ~d International Agronomy Congress, Nov. 26– 30, New Delhi , Indi~. Pp.806–807.

Dinka, T.B.; Goshu, T. A. and Haile, E.H. (2018) Effect of integrated nutrient management on growth and yield of food barley (Hordeum vulgare) variety in Toke Kutaye District, West Showa Zone, Ethiopia. Adv Crop Sci Tech 6 (3):365.

Hemmat, A and Eskandari, I. 2004. Conservation tillage practices for winter wheat–fallow farming in the temperate continental climate of north-western Iran. Field Crops Research 89, 123–133.

Masek, J. & Novak, P. 2018. Influence of soil tillage on oats yield in Central Bohemia Region. Agronomy research 16(3), 838–845.

Mohammad, W.; Shah, S. M.; Shehzadi, S. and Shah, S. A. (2012) Effect of tillage, rotation and crop residues on wheat crop productivity, fertilizer nitrogen and water use efficiency and soil organic carbon status in dry area (rainfed) of north-west Pakistan Journal of Soil Science and Plant Nutrition, 12 (4):715-727.

Monneveux, P., Quillérou, E., Sanchez, C. & Lopez-Cesati, J. 2006. Effect of Zero Tillage and Residues Conservation on Continuous Maize Cropping in a Subtropical Environment (Mexico). Plant and Soil 279(1–2), 95–105. doi:10.1007/s11104-005-0436-3.

Morell, F.J., Lampurlanés, J., Álvaro-Fuentes, J. & Cantero-Martínez, C. 2011. Yield and water use efficiency of barley in a semiarid Mediterranean agroecosystem: Long-term effects of tillage and N fertilization. Soil and Tillage Research 117, 76–84.

Regar, P. L.; Rao, S. S. and Joshi, N. L. (2009) to the effect of in-situ moisture conservation practices on productivity of rainfed taramira (Eruca sativa) in arid Rajasthan. Indian Journal of Soil Conservation, 37 (3):197-200.

Sharma, R. P.; Suri, V. K; and Datt, N. (2001) the integrated nutrient management in summer barley (Hordeum vulgare) in a cold desert of Himachal Pradesh. Indian
Tapanarova, A. (2005) Conservation of soil moisture in deep tillage Rigosol under wheat and maize. *Journal of Agricultural Sciences, Belgrade, 50*(2):139-152.

Titus, Jonathan H. and Del Moral, Roger (1998) Vesicular-arbuscular mycorrhizae influence Mount St. Helens pioneer species in greenhouse experiments. *Munksgaard International Publishers Ltd.* 81(3):495-510.

**How to cite this article:**

Raghvendra Singh, Sarvesh Kumar Pradeep Kumar and Raj Kumar. 2021. Studies 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. *Int.J.Curr.Microbiol.App.Sci.* 10(02): 686-695. doi: [https://doi.org/10.20546/ijcmas.2021.1002.082](https://doi.org/10.20546/ijcmas.2021.1002.082)