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Effect of moisture conservation practices on growth and yield of barley varieties under rain fed condition

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Abstract
The planet is facing the challenge of drought as a result of changing climate patterns. Drought is becoming a serious downside for barley production because major barley-producing countries are located in drier parts of the world and depend on monsoon rain for barley-5 cultivation. In this study, previous works were assessed to explore the effects of drought stress on wheat yield and yield-attributing characters. The plant alters its physio- chemical state. Plant stand, growth charactor, biological yield, grain yield, straw yield, B:C ratio and other yield-attributing characters are all affected by moisture deficiency are impacted, resulting in a reduction in grain yield. The degree of yield loss varies by genotype and crop development stage, and is influenced by a variety of soil, plant, and environmental conditions. Drought stress and its effects are not only a concern of agronomists, but also of plant breeders, due to the relationship between yield and genetic make-up of the crop. barley is the foundation of many food and feed industries, so increasing barley production is essential for the long-term survival of the world's population. The article focuses solely on the effects of drought on yield and yield-attributing factors, as this is a key problem among modern breeders and world leaders.

Keywords: Barley, moisture, yield components

Introduction
Barley (*Hordeum vulgare* L.) is one of the most important cereals of the world. It is cultivated in almost all the parts of the world except hot tropics. The barley crop requires less water than wheat and can tolerate mild degree of salinity and sodicity. The major barley growing countries are USA, Russia, China, Canada, India, France, Australia, U.K., Spain and Turkey. In India, it ranks next to wheat in area and production among winter cereals. Agriculture is largest occupation of India. Most of the people directly or indirectly depend upon the agriculture but it is still a gamble in the hand of mansoon which is precarious, uncertain and extremely fluctuating with respect to its onset, distribution and cessation The global production volume of barley amounted to 156.41 million metric tons in the 2020-21 crop years, increasing from around 140.6 million metric tons in 2019-20. The barley crop is grown in around 70 million hectares of land across the world. Russian Federation is the top country of barley production in the world. As of 2021, barley production in Russian Federation was 20,600 thousand tanes that accounts for 21.85% of the world's barley production. It ranks fifth among crops in grain production in the world after maize, wheat, rice and soybean Worldwide, 30% of the total global barley production is used for making malt and rest 70% is being used as forage for feeding of livestock.

The salient features of this area are low annual rainfall (400-800 mm), high temperature, high rate of evaporation major irrigation potential coupled with low and unstable agriculture production. Barley crop is largely grown on marginal and sub-marginal land with infrequent irrigation. It has ecological and agronomical ranges and is grown under irrigated, rainfed, saline-alkaline late sown, under resource constraint condition. In Rajasthan 80 percent of the crop receive, irrigation whereas in Bihar, West Bengal, Himanchal Pradesh, Jammu and Kashmir over 60 percent of the area is rainfed. In the states of Punjab, Haryana, Uttar Pradesh almost 50% of the area is irrigated.

In India about 48% of the arable area is already under crop cultivation. The recorded food grain production of 210.36 million tonnes in 2003-2004 is hailed as breakthrough on the farm front by international agriculture expert and projected 300 million tonnes by 2015 AD. In UP barley occupied an area of 3.37 lakh ha during 2003-2004 and gave a production of 7.03 lakh metric ton. The average yield of barley is 21.26 q/ha. (Office of the Director Agriculture Statistics and Crop Insurance Krishi Bhawan, Lucknow).

In UP major concentration of barley is in the eastern part especially in Azamgarh and Jaunpur districts where it is grown mainly as a rainfed crop while the west Agra Division shares most of the area where soil is impregnated with salts, Uttar Pradesh ranks Ist both in area under cultivation and production. Barley (*Hordeum vulgare* L.) belongs to family gramineae with plant height 0.75-1.0 meter and is cultivated since time immemorial. It is widely adoptable on various soil and commonly grown as rainfed crop in India. It is cultivated on 2 million hectares and produces about 2.12 million tonnes of grain per year. It is not only used for human consumption but also utilized as feed and fodder for live stock, besides its multifarious Industrial uses such as for malt, beverage and pearl Barley grain are also used for making Sattu and taken as Barley Soup. Barley grain contains 12.3% moisture, 11.5% albumihoids, 74% carbohydrates, 1.3% fat, 3.69% lysine, 7.30% leucine and protein content of new varieties has gone upto as much as 15 16%.

Fertilizer being a costly input in agriculture, efforts should be concentrated to make their use efficacious and judicious through suitable method aimed at maximising fertilizer use efficiency. High fertilizer efficiency synchronized with the physiological stages of plant growth. The nitrogen requirement of a growing plant is less in the early stages of growth maximum during its grand growth period and very low at the subsequent stages upto harvest. It is generally held that split application of fertilizer N at different stages of crop growth is better from viewpoint of plant nutrition as well as fertilizer efficiency. The nitrogen is essential for plant growth as it is a constituent of all proteins and hence of protoplasm. Phosphorus, as a orthophosphate, play a fundamental role in the very large no of enzymatic reaction that depends on Phosphorylation, phosphorus being a constituent of cell nucleus is essential for cell division and development of meristematic tissues. The phosphate taken up by plants gets early concentrated in these tissues which has been successfully demonstrated by the use of radioactive phosphorus. In addition, phosphorus has been observed to regulate the maturity of plants and augment seed formation. The fundamental role of potassium in plant metabolism are undoubtedly regulatory or catalytic. This element is essential for various metabolic activities of the plants especially in the synthesis of simple sugar and starch and in the translocation of carbohydrates. (Harrap, 1960) Potassium effects photosynthesis and physiological processes, as a result of its influence on the chlorophyl components of the plants. High rates of potash reduce the depressing effect of excess nitrogen or phosphorus and promote the mobilization of this nutrients during the peak period of consumption.

Mulches are answer to the mulch waxes problem of moisture conservation in soil. They serve as insulating material against heat or cold and serve as physical barriers at the surface against soul moisture losses. Earlier researches at various dry farming research stations in India have also indicated the usefulness of mulches (Kanitkar *et al*. 1960). Some recent result with synthetic mulches such as plastic and encap are equally encouraging but the economics of their use is prohibitive, obviously, if mulching has to be established as a farm practice, the material deployed must be cheap and preferably the farm waste.

Biometric studies

The following observations on growth characters and yield attributes were recorded at different stages of crop growth and after harvest during the course of experimentation.

1. **Plant stand (000 ha-1):** This study was carried out to know about the uniformity in plant population under different treatments. After final thinning of plants per plot were counted and the time of harvest plant population per plot was also counted to know the mortality of plants.
2. **Plant height:** Height of five randomly selected plants was recorded from base of plant to Tip most fully opened leaf at 30 DAS and 60, 90 DAS at harvesting stage the mean plant height was Expressed in cm.
3. **Number of tillers plant-1:** Total number of tillers emerging from the main shoot was counted.
4. **00-grain weight (g):** For 1000-grain weight sample of grains were taken from the produce of each plot. 1000-grain were counted and weighed on electronic balance.
5. **Grain yield (qha-1):** The yield of grain per plot was recorded in kilogram after threshing and finally converted in qha-1 for all the treatments.
6. **Over yield (qha-1):** The yield of Stover per plot was recorded in finally converted in q ha-1 for all the treatments.
7. **Harvest Index (%):** Harvest index was calculated by the following formula.

$$\text{H.I. (\%)} = \frac{\text{Grain yield (q/ha)}}{\text{Biological yield (q/ha)}} \times 100$$

(Biological yield = Grain yield + Stover yield)

Studies on soil moisture

Soil moisture estimation

Soil moisture was estimated from sowing to harvest of crop at an interval of 30 days. Thermo gravimetrical method was followed for the determination of soil moisture. Soil samples were taken with the help of Screw Auger up to 100 cm depth in four successive layers *viz*. 0-25, 25-50, 50-75 and 75-100 cm from each plot in each replication. The samples were rapidly transferred into aluminum moisture boxes. The fresh weight of soil was determined immediately in the laboratory. The samples were kept in an electric Hot Oven for complete drying at 105 ^{0}C for 24 hours. The moisture percentage was worked out by the following formula:

$$\text{Soil Moisture (\%)} = \frac{\text{Fresh weight of soil-oven dry weight of soil}}{\text{Oven dry weight of soil}} \times 100$$

Soil moisture per cent obtained on gravimetric basis then converted in to the soil water content (mm) on volumetric basis by considering the bulk density of the respective soil layers and depths than calculated as using the following formula.

$$\text{Soil water content (mm)} = \frac{\text{Soil moisture \%} \times \text{B.D.} \times \text{Depth (cm)}}{100}$$

Water use efficiency

Water use efficiency was calculated as ratio of grain yield (kg ha-1) to the consumptive use of water (CU) in mm and expressed as kg ha-1 mm-1.

Seasonal consumptive use value as described by Joshi and Singh (1994).

WUE = Y/ET

Where,
Y = Grain yield (kg ha-1)
ET = Evapotranspiration (Total water use in mm)

Economics
With a view to work out the validity of each treatment, economics was calculated taking into consideration the expenses in each operation. The following aspects of economics were studied.

Cost of cultivation (Rs. ha-1)
Cost of cultivation was calculated in two steps. Firstly as the cost of common to all the treatment and secondly as the variable cost under different treatments, sum of these two were taken as the total cost of cultivation for different treatments.

Gross income (Rs. ha-1)
The treatment wise gross profit was calculated by multiplying the seed and Stover yield ha-1 with the prevailing market prices of the seed and Stover.

Net returns (Rs.)
The relative figures of cost of cultivation for each treatment were deducted from gross profit of the corresponding treatments.

Benefit cost ratio (Rs.)
It is expressed in following formula:

$$\text{B:C Ratio} = \frac{\text{Gross return hectare-1 (Rs.)}}{\text{Cost of cultivation hectare-1 (Rs.)}}$$

Result and Discussion
Plant stand: Application of moisture conservation practices did not differ initial plant stand while the moisture conservation practices significantly influenced plant stand. In initial growth stage crop plants are unable to take huge amount of nutrients supplied through fertility application but at developing and later stage crop plants take sufficient amount of available nutrient which develop healthy plants and restricts mortality there by a non- significant difference was observed in final plant stand. Barley varieties did not influenced significantly in respect of initial and final plant stand.

Growth character: Days to ear emergence and days to maturity which are directly associated with yield attributing characters and yield of crop. In this investigation special attention was paid to this aspect. Among different barley variety moisture conservation practices under the test, the flowering completion was recorded earliest in moisture conservation practices M1 (51.45 DAS) followed by M2 (53.89 DAS) and M3 completed the flowering at last (56.12 DAS). Significant variations between moisture conservation practices in ear emergence apart from genetic characteristics may also be attributed to weather conditions including temperature, radiation, and day length as reported by Evans (1984).
A significant variation was observed between barley and moisture conservation practices at maturity. Moisture conservation practices M1 required minimum days to complete its life cycle, closely followed with M2 however M3 required maximum number of days for maturity. This may be attributed the hereditary characteristics of the moisture conservation practices Toukhy (2008). Plant height of barley was measured at 30 DAS, 60 DAS, and 90 DAS and at harvest. The maximum plant height was noted under organic residue mulch and found maximum height at 60 DAS, 90 DAS and at harvest. Followed by Dust mulching at all the stages of crop growth. The shortest plant height was measured in control treatment. The variation in plant height under different moisture conservation practices was due to variation in water storage in soil. Similar results have also been reported by Awasthi *et al.* (2017) [1]. The significant response was noted in number of tillers per running meter-2 at all the stages of observations under different treatment.
Number of tillers per running meter was recorded higher under variety*K-226* at30 DAS, 60 DAS, 90 DAS and at harvest stage. the second best variety*K-329* produced number of tillers/m row length over *K-603*, but difference was insignificant. Shantveerayya *et al.* (2015) also reported similar results. Organic residue mulching produced the highest numbers of tillers per running meter at all the stages of observations, while minimum numbers of tillers per running meter noted under control treatment. The variation in tillers production per running meter was due to variation in water storage in soil profile. These results are commensurable to the findings of Shantveerayya *et al.* (2015).

Yield contributing characters
The ear length was noted higher in variety *K-226* over the variety *K-329*, but this difference was analysed insignificant. Shantveerayya *et al.* (2015) and Awasthi *et al.* (2017) [1] also reported similar findings.
Organic residue mulching produced significantly longest ear. The shortest ear length was measured in control. The variation in ear length under different treatments was due to variation in conservedmoisture in soil profile. These results are in agreement with those reported by Shantveerayya *et al.* (2015) and Awasthi *et al.* (2017) [1].
The maximum spikelets per spike was counted in Organic residue mulching which was significantly superior to the other tested management practices. The lowest spikelets per spike recorded in Dust mulching treatments may be attributed to the considerably increase in length of ear. The ear length recorded considerably lowest in other treatments, supported to the reduction in spikelets per spike. The other research worker like El- Toukhy and Abdel-Azeem (2000) have also reported variation in spikelets per spike between mulching management practices.
The variety *K-226* produced higher number of spikelets per spike over the variety *K-329*. The longest ear was responsible for higher spikelets per spike. The minimum spikelets per spike was counted under cv. *K-603*. The short length of ear was responsible for lowest spikelets per spike. The difference in spikelets per spike have also been reported by El- Toukhy and Abdel-Azeem (2000).
Organic residue mulching treatments produced significantly higher spikelets per spike than the other moisture conservation practices. The variation in spikelets per spike in different moisture conservation practices was due to variation in length of ear. The lowest spikelets per spike was counted in control treatments. The short length of ear under treatments was responsible for lowest spikelets per spike. These results are in agreement with those reported by Abdel-Azeem (2000).

The significant maximum number of grains per spike was noted in moisture conservation practices, and organic residue mulching (18.26) produced the significant highest number of grains per spike over the other two tested practices. The increase in number of grains per spike in organic residue mulching may be attributed to increase in length of ear and spikelets per spike. The lowest number of grains per spike was recorded (15.53) in control treatment. The reduction in ear length and spikelets per spike in control, supported to the lowest grains per spike. These results are in accordance to the findings of Shantveerayya *et al.* (2015) and Awasthi *et al.* (2017) [1].

The maximum weight of 1000-grain was also noted (39.51g) in variety *K-226*. The lowest 1000-grain weight was weighed (32.16 g) in *K-603* The variation in 1000-grain weight under different varieties was due to genetic variability. These results are in concordant to the findings of Shantveerayya *et al.* (2015) and Awasthi *et al.* (2017) [1].

The significantly highest weight of 1000-grain was weighed (38.65 g) under organic residue mulching practice of moisture conservation. The significant lowest 1000-grain weight was noted (32.43 g) in control treatment. The variation in 1000-grain weight under different moisture conservation practices was due to variation in conserved amount of water in soil profile. These findings are in agreement with those reported by Shantveerayya *et al.* (2015) and Awasthi *et al.* (2017) [1].

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Grain yield

The yield traits *viz*., ear length, spikelets per spike, number of grains per spike and 1000-grain weight also increasing considerably under of organic residue treatment. All the tested treatment showed the reduction in yield parameters, which was supported to the reduction of grain yield of barley under this treatment. These results confirm the findings of Shantveerayya *et al.* (2015), Awasthi *et al.* (2017) [1], Solanki *et al.* (1987) and Tiwari *et al.* (2008).

The grain yield of barley was recorded significantly higher (28.73 q/ha) with variety *K-226* as compared to variety *K-329*. The increase in grain yield in variety *K-226* may be attributed to the considerable increase in ear length, spikelets per spike, number of grains per spike and 1000-grain weight. There parameter reduced considerably in Cv. *K-603*, supported to the reduction in grain yield. These results supported to the findings of Shantveerayya *et al.* (2015) and Awasthi *et al.* (2017) [1].

The grain production of barley was noted significantly higher under organic residue mulching (28.11 q/ha) as compared to other moisture conservation practices. The minimum grain yield was weighed in control treatment (23.58 q/ha).

The minimum grain yield was recorded (23.58q/ha) in control treatment in comparison to other tested treatments. The yield contributing characters *viz*., ear length, spikelets/spike, grains/spike and 1000-grain weight recorded minimum in control treatment, therefore, the reduction in yield contributing characters, supported to minimum production of grain yield in control treatment. Similar results have also been reported by Shantveerayya *et al.* (2015) and Awasthi *et al.* (2017) [1].

Straw yield

The straw yield of barley was recorded maximum (39.21 q/ha) with organic residue treatment as compared to other mulching management practices. The minimum straw yield was weighed (23.59 q/ha) in control condition. The increase in straw yield of barley may be attributed to the considerable increase in tillers/m row length and plant height results of experimentation year.

Barley variety k-226 produced (37.16 q/ha) significantly higher straw yield as compared to variety K-329. The increase in straw yield in variety*K-226* may be attributed to the considerable increase in tillers/m row length and plant height. The tillers/m row length and plant height reduced considerably in variety *K-603,* supported to the reduction in straw yield. These results are in agreement with those reported by Shantveerayya *et al.* (2015) and Awasthi *et al.*

(2017) [1].

Moisture conservation practices, organic residue mulching produced (38.09 q/ha) maximum straw yield over the other practices. The minimum straw yield noted (33.59q/ha) under control treatment. The higher production of straw in organic residue mulching may be attributed to the considerable increase in number of tillers per running meter and plan height.

The lowest straw yield weighed in control treatment in comparison to other tested moisture conservation treatments. The growth parameters *viz*., tillers/m row length and plant height recorded minimum in control treatment, therefore, the reduction in growth parameters, supported to minimum production of straw yield in this treatment. These findings are in agreement with those reported by Shantveerayya *et al.* (2015) and Awasthi *et al.* (2017) [1].

Biological yield

Variety *K-226* produced (67.95q/ha) significantly higher biological yield over the variety *K-329* (61.05q/ha).The increase in biological yield in variety *K-226* may be attributed to considerable increase in grain and straw yields. The grain and straw yields reduced considerably in variety *K-603*, supported to the reduction in biological yield. The results are in agreement with those reported by Narseri *et al.* (2013).

The moisture conservation through organic residue mulching produced (66.20 q/ha) higher biological yield as compared to other tested moisture conservation practices. The increase in biological yield of barley may be attributed to considerable increase in grain and straw yields.

The lowest biological yield noted (57.19 q/ha) in control treatment. The grain and straw yields also declined considerably in control treatment, therefore, reduction in grain and straw yields, supported to reduction of biological yield of barley under control treatment. These results are concordant to the findings of Narseri *et al.* (2013).

Harvest index

The variety *K-226* of barley gave (42.25%) significantly higher harvest index. The higher grain yield ratio in total biomass production under variety*K-226* was responsible for highest harvest index. It shows that the *K-226* has higher potential for grain production. The lowest harvest index was found (41.32%) in variety K-603.

The highest harvest index was worked out (42.25%) in organic residue treatment of moisture conservation practice over other two tested practices. It indicates that moisture management practice has higher potential for grain production. The lowest harvest index was recorded (41.32%) in control. It shows that control treatment has lower potential for grain production. These results confirm the findings of Shantveerayya *et al.* (2015) and Awasthi *et al.* (2017) [1].

Economics

The relative profitability of Barley variety V1variety gave the highest net return of Rs. 22161 ha-1 followed by V2 variety, *i.e.*Rs. 18284 ha-1. While minimum net return Rs. 15351 ha-1 in V3 (Kumar *et al.* 2017 & Mishra *et al.* 2018) [2].

In respect of moisture conservation practices on varieties under rainfed conditions was also studied, Moisture conservation practices M3 (organic residue after 25 DAS) gave highest net return of Rs. 20766 ha-1 followed by moisture conservation practices M2 (dust mulch after 25 DAS). The minimum net return was obtained with moisture conservation practices M1 (control) which gave the net return of Rs. 16491 ha-1 only (Singh *et al.* 2018).

B:C ratio

Barley varieties gave highest net return & B:C ratio is V1– K-226 (Rs.22161)& (1.92) while minimum values of net return & B:C ratio is V3 – K-603 (Rs. 15351 & (1.68) respectively.

Among moisture conservation practices highest values of net return & B:Cratio (Rs. 20766) & (1.83) M3Organic residue mulch after 25 DAS while minimum values of net return & B:C ratio was recorded under control treatment (Rs. 16492) & (1.75) respectively.

Conclusion

Barley is an important *Rabi* cereal crop in India. It has the widest ecological range of adaptation among the cereals and it is widely grown in temperate and sub-tropical regions of the country. It is generally grown on marginal and sub-marginal lands with low inputs where the conditions for wheat and other cereals are not suitable. It is mostly grown on light textural soils which have low nitrogen and organic matter content with poor moisture retentive capacity. It is preferred by the resource poor farmers in the area due to its low input demand, lower cost of cultivation and resistance to drought condition. The cultivation of barley in poor fertile irrigated soils coupled with local varieties, in adequate nutrition and soil moisture stress are the major constraints in barley production. Improved crop varieties, no doubt have a great concern in crop production. Recently a number of improved barley varieties have been developed for different agro-ecological conditions of the state. If such varieties are cultivated with adequate supply of fertilizer nutrients and proper practices of soil moisture conservation are adopted, the productivity of barley in rainfed condition even on poor fertile soils may be certainly enhanced to satisfactory level.

In moisture conservation practices weed management also play an important role in the production technology for increasing productivity of crops, under rainfed condition. Poor or no management of weeds, impair the fertility of soil, soil moisture and natural resources and reduce the yield. Yield is a function of complex inter-relation of various components which are alone or jointly responsible to determine from the growth rhythm in the vegetative phase and their subsequent reflection in the late ontogeny. Number of final plant population, plant height, Days to 50% an thesis& Maturity, number of ear plant-1, number of tiller plant-1, 1000-seed weight are major components for governing the yield. There relative contribution in the manifestation of yield are required to be quantified in the light of treatments effect.

References

1. Awasthi UD, Singh SP, Mishra PK, Prajapati B, Singh A. Productivity and profitability of rainfed barley (Hordium vulgare) crop as influenced by variety, fertility and moisture conservation. Int. J Microbio. App. Sci. 2017;6(6):2952-2957.
2. Chaudhary A, Sewhag M, Hooda VS, Singh B, Kumar P. Effect of different dates of sowing on yield attributes, yield and quality of barley (*Hordeum vulgare* L.) cultivars. Journal of Applied. and Natural Science. 2017;9(1):129-132.
3. Dhillon BS, Uppal RS, Dhaliwal SS. Yield and nutrient

uptake of barley (Hordeum vulgare as influenced by time of sowing and cutting management. International Journal of Chemicals Studies. 2019;7(1):2063-2068.

4. Naseri R, Azadi S, Rahimi MJ, Maleki A, Mirzaei A. Effects of inoculation with Azotobacter chroococcum and Pseudomonas putida on yield and some of the important agronomic traits in barley (*Hordeum vulgar* L.), 2013.