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IMPACT OF FERTILITY LEVELS ON BARLEY (HORDEUM VULGARE L.) VARIETIES' GROWTH AND YIELD IN UTTAR PRADESH'S CENTRAL PLAIN ZONE

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Abstract

To determine the Impact of Fertility Levels on Barley (Hordeum vulgare L.) Varieties' Growth and Yield in Uttar Pradesh's Central Plain Zone, a field experiment was carried out at the agricultural farm of Rama University, Kanpur, during the rabi seasons of 2023–2024.The treatment included three fertility levels (F1 (N, P2O5& K2O)- 40;20;20, F2 -60;30;30, and F3-80;40;40) assessed in a split plot design (SPD), and nine combinations of three varieties (V1-Haritma (K-560), V2-Narmada (K-603), and V3-Lakhan (K-226)).Whereas 'Lakhan' (26.43 q/ha) generated lower grain yield, 'Haritma' (29.51 q/ha) and 'Narmada' (29.40 q/ha) were comparable. The highest grain yield (31.22 q/ha) among fertility levels was achieved by N-80, P-40, and K-40, followed by N-60, P-30, and K-30 (29.27 q/ha), and the lowest yield was recorded by N-40, P-20, and K-20 (24.85 q/ha).

Key word - varieties, fertility, grain yield.

Introduction :

One of the important cereal crops is barley, which is followed by maize, rice, and wheat.One of the oldest crops, barley has been grown for 10,000 years, back in the pre-Harrapan period. Barley was mostly planted and used for human food supply in the previous century, but it is now mostly farmed for animal feed, malt products, and human consumption, respectively. Currently, 70% of barley produced worldwide is utilised for feed and 30% is used for malting.

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Barley is one of the important cereal in the World. It is grown in an area of 70 million hectares with 160 mt grain production.The major barley growing countries are Russia, China, Canada, USA, Spain, France, Australia, UK and India.In India, Barley cultivation is done in area of 6.28 lakh ha with a production of barley is 1.91 million tonnes (DA&FW- 2022-23) .It is cultivated on large scale in case in Uttar Pradesh, and Rajasthan. It is also commonly grown in MP, Punjab, Bihar and Haryana.In Haryana, Western Uttar Pradesh, Punjab, and Rajasthan, it is also grown for malting and brewing, with comparatively superior management to obtain high-quality grain.

An essential component of crop production is fertiliser. Both natural and synthetic fertilisers are essential for improving the growth and productivity of plants. By successfully eradicating illnesses, they increase the value of the harvest by making plants more resistant to damaging infections, pests, and weeds. It also boost the water holding capacity of plants and encourage deeper root growth. Fertilisers containing potassium fortify plant stems and straws. Faster root development and seed generation are made possible by phosphorus. Fertilisers containing nitrogen promote plant growth, as seen by the vivid green hues of plants.

Continuous nutrient depletion from native reserves resulted from the indiscriminate and unbalanced use of plant nutrients, frequently a few below their removal by growing crops. This led to an increase in the quantity of nutrients lacking as well as a growing magnitude of nutrient deficits in the soil. According to Dwivedi (2017), the issue is especially severe in the Indo-Gangetic plains, where cultivars are over fertilising in an attempt to increase yields.

Among the key elements of soil fertility that impact production potential is the soil's capacity to sustain crop growth for maximum crop yields. A number of processes that affect soil fertility and productivity are regulated by the various properties of soil. Gaining knowledge of the physical, chemical, and biological characteristics of the soil will help one comprehend how this light-textured alluvial soil behaves. A significant determining element that impacts crop production is soil fertility.

Material and Method:

During the 2023–24 Rama University agricultural farm in Kanpur, an experiment was carried out in alluvial soil during the rabi season.The experimental field's soil was sandy loam with a slightly calcareous texture, containing 0.35 percent organic carbon, 0.04 percent total nitrogen, 17.2 kg of P2O5 and 17.2 kg of K2O per hectare, pH -7.6, electrical conductivity of 0.38 dS m-1, field capacity of 19.70%, bulk density of 1.48 mg m-1, particle density of 2.64 mg m-1, and porosity of 43.9 °C.Three replications of the split plot design were used for the field experiment, with fertility in the subplot and variation in the main plot.

At the time of seeding, the necessary quantity of urea, single super phosphate, and muriate of potash fertiliser was sprayed in the furrow beneath the seed. On October 30, 2023, barley varieties were sown at a rate of 100 kg ha-1 in furrows spaced 22.5 cm apart behind the country

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plough.Compared to the typical annual rainfall of roughly 800 mm, the amount and distribution of rainfall received during the cropping season in 2023–2024 was 89.2 mm. The current input prices as well as the prices of grain and straw were taken into consideration while calculating the cost of cultivation. The benefit cost ratio, or B:C, was computed by dividing each treatment's gross return by its total cultivation costs.

Result and discussion:

Growth & yield attributes :

At various growth phases, the tallest plants were generated by the variety Lakhan (V3), whereas the variation Narmada (V2) produced the shortest plants. The plant height was greatly impacted by the fertility levels. The tallest plants were found at the F3 level of fertility, which received 80:40:40 kg NPK/ha. At the F1 level of fertility, the shortest comparable value was noted. During the crop's growth at various stages, the various barley types had a substantial impact on effective tillers. Variety V1 (Haritma) had the highest comparable values, whereas variety V2 (Narmada) had the lowest. Furthermore, the application of 80:40:40 NPK kg/ha resulted in the greatest number of productive tillers at the F3 level. On the other hand, the F1 level of fertiliser treatment had the fewest tillers.

The highest earhead count per square metre was recorded by the barley variety Haritma (K-560), which was followed by V2 Narmada (K-603). In contrast, V3 (K-226) Narmada had the lowest earhead count, at 235.Up to the maximum fertiliser application level at the F3 level, there was a significant increase in the number of spikes per square metre as fertility levels rose. (Neelam and others,2019).
Variety V1: K-560 outperformed both varieties V2: K-603 and V3 (Lakhan) in terms of ear weight. Maximum ear weight was produced at the F3 level of fertility, whereas the lowest was produced at the F1 level of fertiliser treatment. variation Lakhan (K-226) had the highest reported 1000 grain weight of 45.20 grammes, while variation Haritma (K-560) had the lowest. At the F3 level, the maximum 1000 grain weight of 45.0 grammes was noted in relation to fertility levels however the minimum values was recorded at the fertility level of F_1 (43.23g).

The Leaf Area Index (LAI) rose as DAS increased, reaching its highest values at 90 DAS before sharply declining. variation Lakhan (V3) had the highest LAI, while variation Narmada (V2) had values that were comparable. Regarding the fertility level, the F3 level of application showed the highest LAI, while the F1 level showed the lowest values. Over the course of several growth phases, dry matter accumulation gradually rises till maturity. Dry matter accumulation was similarly impacted by fertility level, with the highest value observed at the F3 level of fertility, which received 80:40:40 kg NPK/ha throughout the trial. At various growth phases, the F1 level of fertility showed the lowest levels. (Singh et al. 2021 and Choudhary et al. 2017).

Crop yield :

Haritma (V1) had the highest grain yield of 29.51 q/ha, followed by Narmada (V2), while Lakhan (V3) produced the lowest grain yield of 26.43 q/ha.With rising fertility levels, grain production increased significantly, peaking at the maximum fertility level of F3 level with a yield of 31.22 q/ha. On the other hand, the F1 level, which was 24.85 q/ha, was the lowest. 'Haritma' produced the largest yield, which may have been made possible by its long ears, fruitful tillers, and lack of grain. Similar trends were seen in straw yield across several cultivars and fertility levels.

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Table 1: Varieties and fertility levels' effects on barley crop plant height (cm), No. of productive/effective tillers, number of earhead/m² , ear weight and 1000-grain weight.

Treatment	Plant height (cm)				No. of productive/effective tillers				No. of ear head /m²	Ear weight	1000 grain weight
	30 AS	60 DAS	90 DAS	At harvest	30 DAS	60 DAS	90 DAS	At harvest			
Varieties											
V_1	24.9	73.60	90.11	92.10	2.7	6.4	7.6	6.6	261	2.20	43.26
V_2	23.16	71.76	88.73	91.46	2.4	5.6	7.4	5.9	254	2.12	44.06
V_3	26.23	74.50	93.03	97.93	3.0	6.9	8.1	7.0	235	2.04	45.20
SE (d)	**0.632**	**0.769**	**0.301**	**0.784**	**0.083**	**0.072**	**0.112**	**0.152**	**0.385**	**0.022**	**0.737**

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CD(P =0.05)	**1.802**	**N.S.**	**0.859**	**2.234**	**0.237**	**0.205**	**0.319**	**0.434**	**1.097**	**0.063**	**N.S.**
Fertility											
F_1	22.16	71.50	88.45	90.36	2.3	5.4	7.0	5.8	221	2.04	43.23
F_2	24.93	73.20	90.01	93.73	2.6	6.3	7.8	6.4	253	2.12	44.30
F3	27.2	75.16	93.41	97.40	3.2	7.2	8.3	7.3	276	2.20	45.00
SE(d)	**0.548**	**0.783**	**0.560**	**0.501**	**0.103**	**0.152**	**0.158**	**0.142**	**1.544**	**0.014**	**0.855**
CD(P =0.05)	**1.208**	**1.725**	**1.234**	**1.103**	**0.227**	**0.335**	**0.347**	**0.313**	**3.400**	**0.032**	**N.S.**

Table 2- : Effect of varieties and fertility level on yield :

Treatment	Grain yield (q/ha)	Straw yield (q/ha)	Biological yield (q/ha)
Varieties			
V_1	29.5	55.0	84.5
V_2	29.4	54.3	83.7
V_3	26.4	50.8	77.2
SE	**0.856**	**0.257**	**0.5**
CD (P=0.05)	**2.441**	**0.733**	**1.499**
Fertility			
F_1	24.8	47.4	72.2
F_2	29.2	54.8	84.0
F_3	31.2	58.0	89.2
SE	**1.044**	**0.871**	**0.903**

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CD (P=0.05)	**2.299**	**1.918**	**1.988**