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A STUDY OF PREPARATORY TILLAGE AND NUTRIENT MANAGEMENT ON BARLEY YIELD AND ECONOMIC VIABILITY UNDER WATER STRESS CONDITIONS

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Abstract: *In the exploration region, gangatic alluvial soil had a pH of 7.6, indicating a light surface and moderate maturity. As part of preliminary culturing, the three concentrate medications cross-furrow with a cultivator. T1 involved one circle harrow wrinkling and one cultivator cross-wrinkling, while T3 involved one plate harrow wrinkling and one rotavator pass. The preliminary also identified three distinct ways to manage supplement leaders: N1, which applied substance fertilizers at 100% of the Recommended Dose of Fertilizers (RDF) — 120 kg of N, 40 kg of P2O5, and 40 kg of K2O; N2, which applied compound fertilizers at 75% of the RDF despite 25% of Ranch Yard Compost (FYM); and N3, which applied engineered fertilizers at 50% of the RDF despite 50% of FYM. The two-year experiment showed that planting grain crops in plots with one circle harrow wrinkle and one rotavator pass yielded the most outrageous characteristics across advancement factors, yield credits (grain yield q ha-1, straw yield q ha-1, regular yield q/ha, and procure list), net return, gross return, and grain benefit-to-cost extent, as well as applying half RDF through substance fertilizers with half FY. This was consistent throughout two years. The most notable results were from planned culture, which required 100% RDF by furrowing a single cross using synthetic fertilizers and a cultivator. The farming college in Udaipur, Rajasthan, hosted this field study during the rabi season in 2021–2022 and 2022–2023.*

Keywords: *Preparatory Tillage, Barley Yield, Nutrient Management, Water Stress Conditions, Economic Viability.*

1. Introduction

Barley, also known as Hordeum vulgare, is considered to be one of the most significant cereal crops in the world. It is highly prized for its adaptability and versatility in a wide range of environmental circumstances. In addition to being a basic food for human consumption, it is also used as fodder for animals and as a raw material for the industries of whiskey distillation and beer production. The production of barley, on the other hand, is confronted with a multitude of obstacles, one of which is the lack of water, which has a considerable impact on both yield and economic viability. One of the most important factors that influences crop yield is water stress, and this is especially true in dry and semi-arid locations, which are often where barley cultivates. Under conditions of water stress, plants face a reduction in the amount of water that is available to them, which results in physiological drought stress and a reduction in the potential yield. In these kinds of situations, it is absolutely necessary to implement suitable agronomic methods in order to reduce the negative impact that water shortage has on the growth and yield of crops.

The use of preparatory tilling and the management of nutrients are two essential aspects of crop management that have the potential to affect the agricultural productivity and economic viability of barley, particularly in situations where water stress is present. Plowing and harrowing are examples of preparatory tillage activities that have an

impact on the physical qualities of the soil, the ability to retain moisture, and the growth of roots, which in turn has an effect on crop production. Similarly, nutrient management measures, which include the use of fertilizers and organic amendments, play a significant part in the process of giving plants with the vital nutrients they require, boosting their resistance to water stress, and optimizing the potential yield of the plant. Despite the fact that preliminary tillage and fertilizer management are extremely important in barley cultivation, the specific effects that they have under water stress circumstances have received a relatively little amount of research. To lay out feasible yield the board strategies that can limit the impacts of water shortage on farming efficiency, it is crucial to have a strong comprehension of the connections that happen between these agronomic practices and water weight on grain creation and monetary practicality.

Considering this, the reason for this study is to investigate the impacts of starter culturing and supplement the board on the yield of grain and the financial manageability of the harvest when water pressure conditions are available. The purpose of this project is to provide useful insights into the optimization of barley production systems for enhanced resilience and sustainability in water-stressed agricultural regions. This will be accomplished by analyzing the performance of various tillage and fertilizer management strategies in an environment with restricted water resources.

2. Literature Review

Akhtar et al. (2018) a study was done determined to decide the effect that different supplement the executive's medicines have on the development, yield attributes, yield, and quality of wheat (Triticum aestivum L.). Among the different supplement the board medicines, the analysts observed that there were substantial changes as far as development attributes, creation credits, and yield quality. According to their findings, suitable nutrient management approaches have the potential to positively influence wheat production and quality. This highlights the significance of optimizing nutrient application tactics in order to maximize wheat productivity.

Baigys and colleagues (2006) The reason for this study was to explore the effect that different tillage systems have on the efficiency of spring barley and peas, with a particular accentuation on the physical qualities of the soil and the levels of relative dampness. The analysts researched the effect of tilling on the construction of the soil, the water maintenance limit of the soil, and the harvest creation. In their exploration, they found that varieties in tillage rehearses significantly affected the qualities of the soil and how much dampness it contained, which thusly affected the development and efficiency of spring barley and peas. The research shows the significance of using suitable tillage practices in agricultural systems in order to maximize crop performance and optimize soil conditions.

Bajwa, Brar, and Kumar (2002) A number of different tillage strategies were studied to determine how they affected the grain production and energetics of wheat that was grown after rice. The study, which was given in the extended summaries of the International Agronomy Congress, sought to examine the effectiveness of various tillage techniques with regard to the amount of crop production and the amount of energy that was consumed. The researchers examined the impacts of several tillage systems on soil structure, moisture retention, and total crop yield. They evaluated the performance of various tillage systems and analyzed their effects simultaneously. The results of this study offer valuable insights into the selection of optimal tillage strategies for agricultural operations, with the goal of maximizing wheat yield while simultaneously conserving energy resources.

Dinka, Goshu, and Haile (2018) In order to evaluate the impact that integrated nutrient management has on the growth and output of barley, a study was carried out in the Toke Kutaye District of the West Showa Zone in Ethiopia. According to the results of their investigation, the implementation of integrated nutrient management strategies resulted in improvements in the growth parameters and yield of barley types. Furthermore, this hints at the possibility of utilizing nutrient management strategies in order to maximize barley output in agricultural settings.

Habib et al. (2016) The performance of various intercrops that were planted in barley was tested using replacement series and compared. Intercropping is a frequent agricultural practice that the goal of which is to maximize the exploitation of resources and the production of the land. In their study, the researchers investigated the relationship between barley and a number of other intercrop species, with a particular emphasis on the combined effects of these species on yield and agronomic performance. It was proved by their findings that the incorporation of diverse intercrop species into barley production systems is not only feasible but also has the potential to yield advantages. This highlights the significance of crop diversity for the development of sustainable agriculture.

Katiyar and Katiyar (2002) The motivation behind this study is to research the development and yield examples of rainfed barley (Hordeum vulgare) under various nitrogen levels, both as a single harvest and as an intercrop. The reason for this study is to evaluate the impacts that nitrogen levels have on the efficiency and execution of barley, which is an essential staple harvest in numerous agricultural frameworks. The authors provide insights into prospective strategies for optimizing barley production under rainfed settings by exploring scenarios in which lone crops and intercropping are used. In rainfed areas, the findings of this study give potential avenues for increasing barley yields and ensuring their sustainability. This information is a useful contribution to the agricultural community.

Kumari et al. (2019) The motivation behind this study is to evaluate the effect of seed bed alterations and weed administration techniques on the development, yield, and financial parts of wheat creation under natural settings. The motivation behind this study is to research ways of decreasing the effect of weed rivalry and increment wheat yield without relying on manufactured inputs. This exploration covers significant areas of sustainable agriculture. To give useful bits of knowledge to natural wheat cultivating rehearses, the creators lead an analysis of the influence of an assortment of seed bed readiness methodology and weed administration measures. The findings of this study provide light on sustainable approaches to weed control and crop management, giving significant recommendations for farmers who are interested in adopting organic practices while preserving or boosting yield and economic returns.

3. Materials And Methods

Apparently, you have point by point a field try that was directed during the rabi time of 2021-22 and 2022-23 at the rural college in Udaipur, Rajasthan. The pH of the gangatic alluvial soil that was used for the experiment was 7.6, which indicates that it was a light-textured soil with a moderate level of fertility. The annual rainfall in the region often falls around between 800 and 850 millimeters on average.

The trial medicines contained primer culturing methods. T1 involved one cross wrinkling with a cultivator, T2 contained one circle harrow wrinkling followed by another cross wrinkling with a cultivator, and T3 included one plate harrow wrinkling despite one rotavator pass. There were three unique renditions of nutritional administration

medicines: N1 was a 100 percent Supported Measure of Fertilizers over Chemical Stimulant, N2 was a 75% RDF over Chemical Stimulant pooled by 25% FYM, and N3 was a half RDF over Chemical Stimulant coupled with half FYM.

The experimental field had a sandy loam surface, was slightly calcareous, and had the following explicit soil properties: wilting point at 6.2%, field limit at 18.38%, water holding limit at 29.7%, bulk thickness at 1.40 Mg m-3, particle thickness at 2.50 Mg m-3, O.C. - 0.32%, whole N at 0.033%, phosphorus at 16.85 kg ha-1, accessible potash at 130.30 kg ha-1, EC at 0.34 dS m-1, bulk thickness at 1.40 Mg m-3, Particle thickness at 2.50 Mg m-3, and porosity at 43.97%. Several viewpoints were thought about, including the following: Through the process of hand threshing and weighing the seed production from each plot, the grain/seed yield (q–1) is turned into q ha–1. When the seed yield is removed from the total amount of biomass generated by each plot, the term "straw yield" (q ha-1) is used to describe the amount of biomass produced overall. In order to calculate the biological yield (q ha-1), which is then expressed, crops are harvested after the dry, net plot area has been taken into consideration after harvesting. For the purpose of determining the harvest index (percent), which indicates the degree to which CO2 fixation and acclimatization are utilized, a specific formula was utilized.

It would appear that you were attempting to illustrate the process by which these agricultural parameters were measured in the experimental plots. Furnish me with data on the off chance that there is a particular computing technique or recipe that you need support with. (%) = Seed/grain yield (q ha-1) isolated by the natural yield (q ha-1) duplicated by 100

Duplicating the yield of grain, seed, and straw per hectare by the ongoing business sector values for seed and straw is the technique that is utilized in financial matters to get the gross appearance, which is communicated as rupees per hectare. To decide the net return (Rs ha-1), the gross pay of the medicines that were predictable was decreased from the separate costs of development for every treatment. The term "cost ratio" refers to the proportion of gross profit to the total cost of cultivation, often known as the return on investment.

4. Results And Discussion

4.1. Yield of Barley Crop

Table 1 displays the findings of statistical studies conducted in both years to determine the effects of nutrient management and preliminary tillage practices on the yields of the barley crop in terms of grain, straw, and biological components.

Plots that were treated to T3, which consisted of one tillage with a disc plow followed by one pass by a rotavator, appear to have provided the highest yields in terms of grain, straw, and biological yield among the various preparatory tillage methods that were tested. T2, which consisted of one session of cross-ploughing with a cultivator and one session of plowing with a disc harrow, followed closely after and yielded results that were similarly fairly satisfactory. On the other hand, plots that were treated to T1, which consisted of only one cross ploughing with a cultivator, generated the least amount of straw, yields in grain, and biological produce.

These results demonstrate the impact that different preparatory tillage techniques have on barley yields. Additionally, they demonstrate that T3 and T2 perform better than T1 (one cross plowing with cultivator) in terms of improving straw, grain, and biological yield in the years that were designated for the experiment.

Preparatory tillage, more especially T1 treatments that included one cross-ploughing with a cultivator, resulted in a greater harvest index for both years' results when compared to technologies that involved further preparatory

ploughing. The T3 treatments, which consisted of one cross-plowing with a rotavator and one disc harrow, ended up having the lowest harvest index during the course of the trial year.

There were a number of different nitrogen management treatments, but the ones that resulted in the highest yields of barley (q/ha), biological yield, and straw yield were the ones in which N3) fifty percent of the necessary fertilizer dose was mixed with fifty percent farm yard manure (FYM), and then N1) was applied. In the years 2021-22 and 2022-23, the minimum grain yield, straw yield (q ha-1), and biological yield (q ha-1) of barley that was seen under treatment N1-100 percent were significantly appreciated. On the other hand, the amount of fertilizer used was 75% chemical fertilizer and 25% manure from the farm yard applied.

The second-year harvest index under nutrient management treatments, specifically N1 treatments—100% RDF (dosage through chemical fertilizer), recognized its expressively maximal over all other techniques for managing nutrients during the period of 2021-22. The highest harvest index (percentage) can be achieved with nutrient management treatments, namely N2 treatments, which consist of a 75% fertilizer dose through chemical fertilizer and 25% farm yard manure throughout the years 2021–2022. Therefore, the H.I. over N3 treatments that resulted in the lowest H.I. in both years was a combination of fifty percent farm yard manure and fifty percent reconstituted dung (RDF).

Table 1: Impact of nutrient management techniques and preparatory tillage on barley's harvest index (%), biological yield, grain yield, and straw yield

Treatments	Grain yield		Straw yield		Biological yield		Harvest index	
	(2021-22)	(2022-23)	(2021-22)	(2022-23)	(2021-22)	(2022-23)	(%) (2021-22)	(%) (2022-23)
Preparatory Tillage (T)								
T1	36.36	36.97	43.67	43.26	68.7	68.12	54.97	54.78
T2	36.85	38.28	45.36	46.87	68.82	74.34	53.89	54.18
T3	37.63	39.29	47.66	49.52	73.45	77.7	53.78	53.53
SE (d)	1.56	1.63	1.89	2.26	2.28	2.53	1.38	1.43
CD (P=0.05)	1.86	2.21	3.18	3.58	3.64	4.85	1.68	1.79
Nutrient Management (N)								
N1	35.48	36.32	42.89	43.18	67.28	68.4	54.3	55.14
N2	36.89	37.77	45.97	46.34	71.26	73.8	54.37	54.28
N3	38.25	39.44	47.83	48.4	74.58	78.75	53.96	52.89
SE (d)	1.561	1.63	1.89	2.27	2.28	2.53	1.38	
CD (P=0.05)	1.86	2.21	3.18	3.58	3.64	4.85	N.S.	1.79

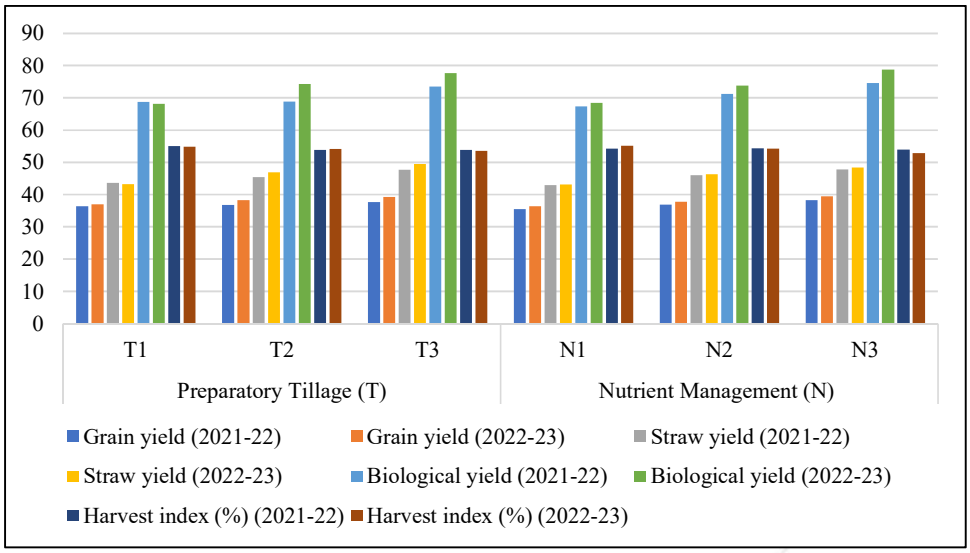

Figure 1: Impacts of pre-culturing and supplement the executives' strategies grain, straw, natural, and reap file (%) are shown graphically.

Table 2: Effect of supplement the board procedures and preliminary culturing on gross return (Rs ha-1), Net return and B: C Ratio of barley

Treatments	Gross return (Rs ha-1)		Net return		B: C Ratio	
	2020-21	2021-22	2020-21	2021-22	2020-21	2021-22
Preparatory Tillage						
T1	58412	62668	31321	28861	2:2.79	2:2.73
T2	61849	67651	31846	34886	2:2.79	2:2.84
T3	63932	68435	34225	37828	2:2.87	2:2.92
SE (d)	2287.8	562.4	546.3	489.43	1.13	1.12
CD (P=0.05)	3585.72	867.87	833.74	953.95	NS	0.04 1.15
Nutrient Management						
N1	58959	63192	28666	31763	2:2.78	2:2.76
N2	62494	66771	32722	34441	2:2.83	2:2.82
N3	64741	68791	33983	37792	2:2.84	2:2.91
SE (d)	2287.8	562.4	546.3	489.43	1.13	1.12
CD (P=0.05)	3585.72	867.87	833.74	953.95	1.16	1.15

4.2. Economics of Barley

The data presented in Table 2 makes it abundantly clear that the preparatory tillage treatment (T3), which consisted of one ploughing with a disc harrow and one pass with a rotavator, yielded the highest gross return and net return. This was followed by treatment T2, which consisted of one ploughing with a disc harrow and one cross ploughing with cultivator, and it earned Rs., net return. The minimum net return, gross return, was calculated under treatment T1 (one cross plowing with cultivator) during the years 2021–22 and 2022–23, respectively.

In the first year under T1 treatments, which consisted of one cross plowing with cultivator during the years 2022–23, the cost ratio was found to be the lowest. On the other hand, it was found to be the highest in the first year under T3 treatments, which consisted of one plowing with a disc harrow and one pass with a rotavator.

5. Conclusion

The review shows that different primer culturing strategies impressively affect grain yields. The most significant returns of grain, straw, and organic matter were gotten with T3 (one furrowing with a plate harrow and one pass with a rotavator). T2, which comprised of one plate harrow furrowing and one cultivator cross-furrowing, yielded the greatest grain, straw, and organic yields. T1 (1 cross plough with cultivator) yielded grain yields of 36.36 & 36.97q ha-1, straw yields of 43.67 & 43.26 q ha-1, and biological yields of 68.70 & 68.12 q ha-1, which were the lowest yields recorded. The study also emphasizes how important preliminary tillage techniques are for increasing barley yields, with a preference for T3 and T2. N3 (50% RDF + 50% FYM) nutrient management strategies yielded the highest grain, straw, and biological yields. Straw yield, biological yield, and grain yield were all produced by N2 (75% RDF + 25% FYM). On the other hand, N1 employing the RDF showed the lowest output. In 2021-2022 and 2022-2023 grain gave the most noteworthy gross return and net return for the T3 treatment. During these years, the N3 treatment (half RDF + half FYM) had the most extreme awful return and net return. The N1 therapy yielded the lowest net return and gross return figures. In 2021–2022, the application of 50% RDF + 50% FYM nutrient management strategies yielded the optimum benefit–to–cost ratio.

6.References

1. *Akhtar, N., Ramani, V. B., Yunus, M., & Vala, F. (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.*
2. *Baigys, G., Feiza, V., Kutra, G., & Feiziene, D. (2006). 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.*
3. *Bajwa, J. S., Brar, S. S., & Kumar, S. (2002). Effect of different tillage systems on grain yield and energetics of wheat sown after rice. In Extended Summaries of International Agronomy Congress, New Delhi, India (pp. 806-807).*
4. *Dinka, T. B., Goshu, T. A., & 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.*
5. *Habib, M. K., Dhaka, A. K., Kumar, S., Singh, B., & Kumar, N. (2016). Performance of different intercrops sown in barley with replacement series. Annals of Biology, 32(2), 178-183.*
6. *Katiyar, S. C., & Katiyar, A. K. (2002). Growth and yield of rainfed barley (Hordeum vulgare) growth as sole and intercrop under different nitrogen levels. Indian Agriculturist, 46(3/4), 219-224.*
7. *Kumari, P., Saini, J. P., Kumar, R., Chopra, P., & Sharma, R. P. (2019). Impact of seed bed manipulations and weed management practices on growth, yield and economics of wheat under organic conditions. International Journal of Current Microbiology and Applied Sciences, 8(8), 2889-2897.*

8. *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.*
9. *Mukherjee, D. (2015). Influence of various tillage options along with nutrient management practices in maize–wheat cropping system under mid-hill situation.*
10. *Ram, H., Dadhwal, V., Vashist, K. K., & Kaur, H. (2013). Grain yield and water use efficiency of wheat (Triticum aestivum L.) in relation to irrigation levels and rice straw mulching in northwest India. Agricultural Water Management, 128, 92-101.*
11. *Reddy, B. C., Singh, R., Praveena, R. S., & Sohail, A. (2018). Effect of sowing dates and levels of nitrogen on yield attributes, protein content and economics of barley (Hordeum vulgare L.). International Journal of Current Microbiology and Applied Sciences, 7(8), 435-440.*
12. *Regar, P. L., Rao, S. S., & Joshi, N. L. (2009). Effect of in-situ moisture conservation practices on productivity of rainfed taramira (Erucasativa) in arid Rajasthan. Indian Journal of Soil Conservation, 37(3), 197-200.*
13. *Saini, M. K., & Walia, U. S. (2010). Effect of planting patterns and weed control treatments on Phalaris minor growth and productivity of wheat (Triticum aestivum). Indian Journal of Agronomy, 55(2), 110-113.*
14. *Sharma, R. P., Suri, V. K., & Datt, N. (2001). Integrated nutrient management in summer barley (Hordeum vulgare) in a cold desert of Himachal Pradesh. Indian Journal of Agricultural Sciences, 71(12), 752-755.*
15. *Tapanarova, A. (2005). Conservation of soil moisture in deep tillage Rigosol under wheat and maize. Journal of Agricultural Sciences, Belgrade, 50(2), 139-152.*