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ASSESSING THE ECONOMIC IMPACTS OF INTEGRATED NUTRIENT MANAGEMENT PRACTICES ON BARLEY CULTIVATION

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Abstract: *In order to address the issues that the malting barley business often faces with regard to volume and quality in order to satisfy demand, the research set out to evaluate the effects of integrated nutrient management strategies on the financial aspects of barley production. The Maharana Pratap University of Agriculture and Technology's study Farm in Udaipur, Rajasthan, was the site of the 2022–2023 rabi season study. Classified as a sandy loam, the experimental soil had a pH that was somewhat alkaline, low amounts of organic carbon and nitrogen, and medium availability of potassium and phosphorus. The trial was done in a Randomized Block Plan and was reproduced multiple times. As per investigation, grain creation under treatment T10 delivered observably more prominent gross returns, net returns, and advantage cost proportions. Medicines T9 (RDN) and T10 showed comparable financial execution to treatment T8 (75% RDN + Biomix + Vermicompost @ 5 t ha^-1) showing no massive contrasts in reap and fascination lists across various mixes of nitrogen manure, biomix, and vermicompost.*

Keywords: *Barley, Nutrient Management, Hordeum Vulgare, Nutrient Management.*

1. Introduction

Worldwide agricultural systems rely heavily on the production of barley (Hordeum vulgare L.), a staple grain used for human food, animal feed, and a variety of industrial uses. To satisfy the needs of the brewing and distilling industries, in particular, the malting barley business is highly dependent on the supply of high-quality barley grains. Farmers and other industry participants continue to face difficulties in maintaining a sufficient volume and quality of barley output.

Practices such as Integrated Nutrient Management (INM) provide a comprehensive strategy for maximizing agricultural output while guaranteeing resource sustainability and environmental preservation. INM techniques work to increase soil fertility, improve nutrient availability, and support balanced plant development by mixing organic and inorganic nutrient sources. Adopting Integrated Nutrient Management (INM) strategies in barley cultivation has the potential to significantly improve crop yields, rectify shortages in soil nutrients, and increase the financial sustainability of barley production systems.

In light of this, the goal of this research is to determine how integrated nutrient management techniques affect barley farming economically. The study specifically aims to assess how various INM techniques affect

important economic metrics, such as benefit-cost ratios, net returns, and gross returns. Through a thorough examination of barley's economic performance under different INM treatments, this research seeks to provide important insights into the viability and sustainability of INM methods when applied to barley production systems.

This project aims to promote sustainable agricultural practices and improve economic results for barley producers and stakeholders by thoroughly examining the economic consequences of INM methods on barley farming. This research seeks to enlighten decision-making processes and assist the adoption of environmentally friendly and commercially viable agricultural practices in barley cultivation systems by clarifying the link between INM techniques and economic performance in barley production.

The expression "integrated nutrient supply, usage, or managing systems" (INM) alludes to a framework that covers the productive and mindful supply, use, or monitoring of the multitude of essential parts of plant nutrient assets. These parts incorporate substance composts, creature excrements, fertilizer, and green excrements. For the motivation behind cultivating soil fruitfulness, wellbeing, and creation, the utilization of vegetables in trimming systems, bio-composts, crop extras, or recyclable waste joined with other locally available nutrient assets are advantageous. When chemical fertilizers and organic manures are administered at the same time, it has been established that the integrated supply and utilization of plant nutrients results in better crop yields than when each of these fertilizers and manures are treated separately. This upsurge in crop efficiency results from their common and agreeable outcome, that helps to propel substance, physical and natural hero of soil and hence the dirt organic matter and nutrient remaining; to immense degree balanced nutrient supply to yields of editing systems, and with no or negligeable harmful impact on climate if any.

The basic role of the integrated nutrient supply and the executive’s framework is to give, furthest degree conceivable, an unbiased nutrient supply to the harvest. This supply jelly and furthermore improves the richness soundness of the dirt, which is important for keeping up with elevated degrees of creation over a lengthy timeframe. The pertinent combination(s) of plant nutrient sources to a creation approach for ideal and balance nutrient supply changes relying upon the land use, ecological, social, and monetary conditions. This is because of the way that plant nutrient sources vary essentially in their nutrient substances, conveyance proficiency or interest, positional accessibility, crop particularity, and rancher propriety, among different factors. The main commitments of present-day innovation are composts and excrements, which have been liable for a fifty to 60% increment in the development of food grains in India, in spite of the way that dirt and agroecological zone are as yet important factors. However, if there is not an integrated supply and utilization of plant nutrients derived from both chemical fertilizers and organic sources, then there is no significant possibility of enhanced output. A significant boost in yields is produced by the HYV as a result of the translation of the chemical energy contained in fertilizers and manures into biomass that has a greater percentage of grain to straw. The use of fertilizers is the most

effective method for saving land in nations like India that have a limited amount of land. On the other hand, with this strategy, it would have been anticipated that around two to three times more land would be devoted to cereals in order to produce the same quantity of food grains.

2. Literature Review

Khajoei-Nejad, G., and J. Ghanbari (2021) the experimental outcomes from two growth seasons that were conducted in semi-arid environments in order to achieve this goal. The review included numerous nutrient administration techniques, including chemical fertilizers (CF) that were either non-immunized with arbuscular mycorrhizal (AM) parasite (Glomus mosseae) or vaccinated with manure (COM), manure + biochar (COM + B), and control (non-corrected soil). The findings showed that when saffron was inoculated with AM, CF fertilization dramatically enhanced the total biomass, nutrient absorption, and nutrient usage efficiency of the plant. Results also indicated that adding only organic amendments improved total biomass, nutrient uptake, and nutrient use efficiency in AM-inoculated plots. These improvements were accompanied by a significant increase in soil pH, available phosphorus (P), soil organic carbon (SOC), cation exchange capacity, and bulk density. Additionally, during the 2015–2016 growing season, we discovered that inoculating organically modified plots with AM enhanced the amount of P accessible in the soil by promoting SOC breakdown. This was accompanied by greater P absorption and P usage efficiency, particularly during the 2016–2017 growing season. Furthermore, COM + B and non-amended soils showed reduced soil N content, poorer nitrogen absorption (NU), and worse nitrogen utilization efficiency (NUE). Higher C:N ratios, which indicate a negative correlation between the C:N ratio and N acquisition parameters, might be blamed for this reduction. On the other hand, with COM-amended soil, AM-inoculation markedly enhanced N content and consequently N acquisition. It is reasonable to conclude from the study's findings that using chemical fertilizers injected with AM is a viable strategy for improving saffron's biomass output and nutrient uptake.

Breland, T. A., Vatn, A., Kvakkestad, V., & Steiro, Å. L. (2020) In this research, a unique IPM index based on self-reported levels of IPM practice execution was used to gauge the adoption of IPM concepts among Norwegian grain farmers. The index's guiding concepts and practices were apportioned a weight by three IPM specialists. They concluded that the most crucial principles were prevention and suppression, next monitoring and decision-making, and finally pesticide selection and assessment. According to a poll of 1250 farmers, the concepts that were most often adopted were assessment and anti-resistance tactics, while non-chemical approaches and less pesticide usage were least widely adopted. The findings corroborate earlier theories that more complicated concepts need a wider range of actions and are thus less likely to be embraced than simpler ones. Despite this, the index scores showed that the majority of grain farmers in Norway are heavily using IPM; 75% of the respondents received scores on a 100-point scale between 60 and 80, with an average score of 68. It is more pertinent to talk about how IPM is

used differently in the Norwegian context than it is to address how to boost adoption generally.

Bell, R. W. (2020) weed administration methods stood out chemical controls alone from an integrated technique, while the nutrient administration medicines subbed some nitrogen with massive (barnyard fertilizer; vermicompost) and concentrated organic excrements (Brassicaceous seed dinner, BSM; neem cake). By lowering weed N intake, BSM's N supplementation inhibited weed development while increasing the uptake of nutrients by the maize crop. When atrazine was treated before to emergence and then hoed, the weed density was decreased by 58 and 67% in years 1 and 2, respectively, in comparison to the use of just chemicals. When compared to applying N via synthetic fertilizer, the BSM treatment boosted yield in year 2 and produced the greatest yield of maize grain. When combined with herbicide, hoeing increased maize grain production by 9% compared to herbicide alone. When joined with the integrated weed control method, the utilization of BSM for N supplementation brought about the most elevated net return and financial proficiency.

Singh, G., Pandey, R., Sharma, A., Darjee, (2023) Involving different blends of biofertilizers notwithstanding the suitable manure portion, a field try was done to evaluate the impact of INM on limiting N misfortunes and further developing wheat (Triticum aestivum L.) creation and development measurements. When contrasted with applying NPK (Tr) alone, the mix of NPK + Azotobacter + mycorrhiza (Cable car) was displayed to improve soil nitrogen elements, P and K accessibility, microbial movement, root development, urease action, and nitrogen usage effectiveness. Denitrification misfortunes went from 2.4 to 2.5 kg ha−1, though the combined outflow from alkali stream in the INM plot differed from 10.2 to 10.6 kg ha−1. These were additionally seen to be a lot higher in the Tr plot at a similar period. 6.4 t ha−1, more prominent than different medicines, was the yield estimated under the INM plot getting Cable car.

Ahmad, S., El-Shehawi, A. M., Hussain, M., (2021) The research was carried out in Mulan, Pakistan's Bahauddin Zakariya University's Agriculture Research Farm. Inorganic and organic sources of N were used to produce wheat and maize crops at the required dosage, either in isolation or in conjunction with biofertilizer; no N treatment was used as a control. Soil organic carbon (SOC) and root biomass yield data were gathered. Root biomass and SOC were greatly increased by using organic fertilizer both on its own and in conjunction with inorganic and biofertilizer. The efficiency of the wheat-maize editing framework was upgraded by further developed SOC and crop underground root growth. The utilization of simply inorganic manure expanded crop yield yet no affected SOC. For maize and wheat crops, separately, an integrated N the executives approach (involving half organic and inorganic compost notwithstanding biofertilizer) expanded crop creation, net advantage, and SOC.

Misganaw, A., Adane, M., and Alamnie, G. (2020) In light of this, this study evaluated the combined effects of organic and inorganic fertilizer sources on barley production and yield components. As a result, one of the key elements influencing the sustainability of barley production is preserving soil fertility. To achieve balanced nutrient management for barley

output, the benefits of using both organic and inorganic fertilizers must be combined. This audit research showed that keeping up with grain creation and yield parts requires offset preparation with both organic and inorganic fertilizers. The basic thought behind the consolidated manure applications is to enhance the advantages from all potential plant nutrient sources in an integrated manner while changing soil fruitfulness and plant nutrient supply to an optimal level for keeping up with designated grain efficiency. Thus, more focus should be placed on creating an integrated approach to managing soil fertility that balances the use of all nutrient sources, including both organic and inorganic fertilizers, to maintain or improve soil productivity.

3. Material And Methods

The Maharana Pratap University of Agriculture and Technology, Udaipur, Agronomy Research Farm, located at a latitude of roughly 24°35' North and a longitude of 73°41' East, with an elevation of approximately 592 metres above mean sea level, was the site of the field experiment, which was carried out during the rabi season of 2022–2023. Rajasthan's dry to semi-arid climatic zone includes Udaipur. The sandy loam soil used for the experiment had a pH of mildly alkaline and had around 62.8% sand, 19.5% silt, and 16.9% clay. It was discovered that the soil had a medium level of accessible potassium and phosphorus and low levels of organic carbon and nitrogen.

On December 1, 2020, the crop was manually sown using a hand plough with a pora technique, drilling in rows that were around 22 cm apart at a depth of 5.0 cm. On November 18, 2020, a pre-sown irrigation was applied at a depth of 5 cm. On April 20, 2022, the plants were physically harvested from each plot, using sickles to chop the plants from their assigned areas independently.

Full dosages of potassium and phosphorus, as well as half of the treatment's nitrogen, were broadcast and mixed into the soil using DAP, MOP, and urea, respectively, before barley was sown. The initial irrigation included a top dressing of the remaining half of nitrogen. Prior to barley seeding, vermicompost @ 5 t ha^-1 was added to the soil in accordance with treatment guidelines. Other cultural customs were followed in accordance with advice specific to the crop.

The cost of each treatment was determined by carefully evaluating fixed and variable expenses, such as labor, chemicals, plant protection, seed, and preparation of the ground for different activities. The barley crop's grain and stover yields were taken into account while calculating the gross revenue for each treatment individually. After that, net returns were calculated by deducting the cost of each treatment from the corresponding gross revenue.

This modification guarantees that the approach conforms to the physical and meteorological parameters of Udaipur, Rajasthan, while preserving the integrity of the initial experimental blueprint and protocols.

4. Results And Discussion

Comprehensive information on the benefit-cost (B:C) ratios, net returns, and gross returns for different agricultural treatments is included in the table. These treatments cover a variety of techniques, such as applying Biomix, applying reduced doses of nitrogen

(RDN) in various combinations with Vermicompost and Biomix, or using RDN alone. Vermicompost is applied at a rate of five tons per hectare. The overall income from crop output, or gross returns per hectare, varied across treatments and ranged from 51,524 to 85,543 Rs ha^-1. Similarly, there was a broad range in the figures of net returns, which indicate profitability after subtracting production expenses. They ranged from 26,054 to 57,568 Rs ha^-1. The benefit-cost ratios, which show how profitable and efficient each therapy was, varied significantly in terms of economic performance, ranging from 2.03 to 3.18. Furthermore, the crucial difference (CD) at a 5% significance level and the standard error of the mean (SEm ±) provide information on the statistical significance of treatment differences and the dependability of the reported mean values, respectively. With the use of this data, researchers and farmers may assess and choose agricultural strategies that maximize returns while taking production costs and statistical validity into account.

Table 1: Impact of integrated nutrient management techniques on barley's economics

Treatment	**Gross Returns (Rs ha^-1)**	**Net Returns (Rs ha^-1)**	**B:C**
T1	51524	26054	2.03
T2	55967	30463	2.18
T3	63755	34289	2.17
T4	67916	38408	2.4
T5	76317	46304	2.55
T6	80425	50142	2.68
T7	80959	50908	2.68
T8	82438	52115	2.73
T9	84122	57568	3.18
T10	85543	54948	2.9
SEm ±	1075	706	0.18
CD at 5%	3236	2125	0.46

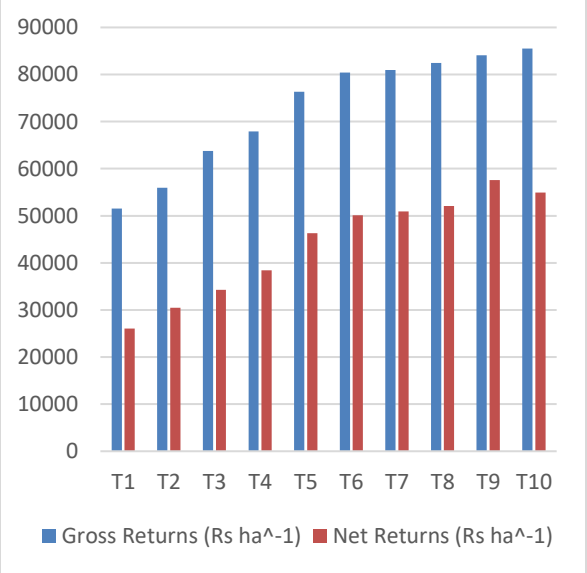

Figure 1: Impact of integrated nutrient management techniques on barley's economics

Table 2: Impact Of Integrated Fertilizer Management Techniques on Barley's Harvest and Attractiveness Index

Treatment	**Harvest Index (%)**	**Attraction Index (%)**
T1	32.62	48.37
T2	33.64	50.73
T3	33.96	51.37
T4	34.27	52.06

T5	32.44	47.96
T6	32.48	48.07
T7	32.23	47.57
T8	32.59	48.33
T9	33.4	49.73
T10	33.16	49.54
SEm ±	1.92	2.64
CD at 5%	NS	NS

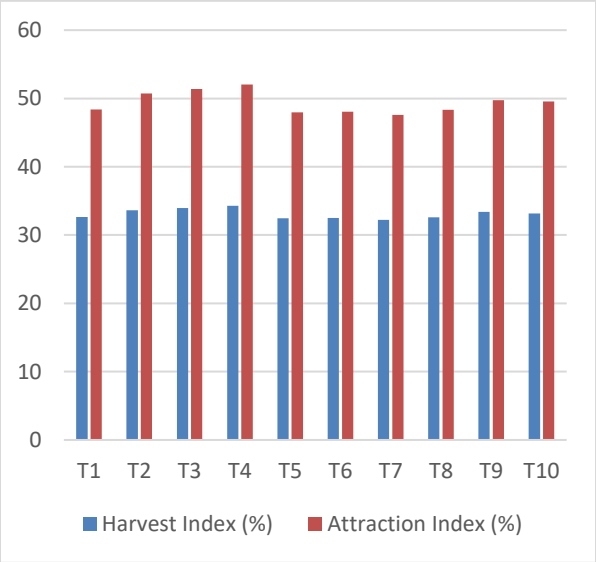

Figure 2: Impact Of Integrated Fertilizer Management Techniques on Barley's Harvest and Attractiveness Index

The information shown sheds light on how different treatments affect crops' Harvest Index (HI) and Attraction Index (AI). T4 (Biomix + Vermicompost @ 5 t ha^-1) produced the greatest HI (34.27%) and AI (52.06%) of all the treatments, suggesting that biomix and vermicompost may work in concert. The control treatment (T1), in comparison, had an AI of 48.37% and an HI of 32.62%, indicating that the soil amendments, especially when coupled, may improve both indices. Notably, HI and AI values were mostly consistent or slightly lower in treatments with decreased nitrogen levels (50% and 75% RDN) in conjunction with vermicompost and biomix (T7 and T8). These treatments did not, however, significantly outperform the control. Both indices showed modest increases when RDN was used alone (T9) and in conjunction with biomix and vermicompost (T10), although these effects were not as noticeable as they were when T4 was used. The standard error of the mean (SEm ±) and the critical difference (CD) indicate that statistical analysis reveals that the changes observed are not significant (NS) at the 5% confidence level. As a result, even while there are discernible patterns, the available data do not allow for a firm determination that the differences between treatments are statistically significant.

5. Conclusion

The results of the research demonstrated that comprehensive nutrition management had a significant positive impact on the economic profitability of barley. It was established that treatment T10 had the highest gross returns (Rs 85543 ha-1) after a year of study, followed by treatment T9 and treatment T8 and then treatment T8. T9 was the treatment that yielded the highest net returns out of all the different combinations of nitrogen fertilizer, biomix, and vermicompost. T10 and T8 were the treatments that came in second and third, respectively. In terms of the BC ratio, the treatment with the greatest ratio was T9, followed by T10 and then T8. Generally, the Integrated Nutrient Administration treatment brought about higher gross returns, net returns, and advantage cost proportions. These were the outcomes.

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