

STUDIES ON INTEGRATED NUTRIENT MANAGEMENT IN RICE

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ABSTRACT

An experimental trial was conducted during summer (Kharif) seasons under hybrid rice (Pant Sankar Dhan-3) during 2015 Telbal area of district Srinagar (J&K) to evaluate the direct effect of integrated Nutrient management on hybrid rice. The study site was located at an altitude of 1577 m amsl. The soil were sandy loam in texture, low in organic carbon (0.15%), medium in phosphorus (18.2 kg ha⁻¹ and potassium (210 kg ha⁻¹). Highest grain yield of 68 q ha⁻¹ was recorded in treatment 10 (T₁₀) and maximum plant height was recorded in Treatment T₇. Highest number of panicles m⁻² (405) were recorded when the crop was fertilized with NPK (50%) + Neem cake @ 2.5 t ha⁻¹ + FYM @ 5.0 t ha⁻¹ + PSB @ 5.0 kg ha⁻¹ + Azotobactor. The highest nutrient uptake was in T₁₀ in which organic and inorganic sources of nutrients were applied. The lowest uptake of total nitrogen, Phosphorus and potassium was found under T₁ (control followed by T₃. Substitution of 50 % of NPK through 10 to 15 tones of FYM or integrated use of (NPK (50%) + Neem cake @ 2.5 t ha⁻¹ + FYM @ 5.0 t ha⁻¹ + PSB @ 5.0 kg ha⁻¹ + Azotobactor) in hybrid rice crop resulted into higher productivity of hybrid rice over application of 100% NPK through chemical fertilizers. The treatment module T₅ was also the most effective treatment for causing increase in grain yield with higher returns than T₁₀.

Keyword: Hybrid, Integrated Nutrient management, Rice, Soil.

I. INTRODUCTION

Rice (*Oryza sativa*) is one of the most important food crops in the world, forms the staple diet of 2.7 billion people. It is grown in more than hundred countries with a total harvest area of approximately 158 million hectares, producing more than 700 million tons annually. Being the staple food for more than 65% of the people, our national food security hinges on its growth and stability. Rice being staple diet of the majority in Kashmir valley and is grown on an area of 140 lac hectares once in a year only because of the extreme climatic

conditions. Average productivity of rice in the state is 2 tones /ha which is far below the realizable potential. Several long-term experiments all over India indicated a decrease in rice productivity due to continuous use of chemical fertilizers. Integrated nutrient management (INM) has an important role, which improves efficiency substantially to maintain a high level of productivity and rice production [1]. To enhance productivity a holistic approach is needed that aims at the efficient and judicious use of all the sources of plant nutrients in an integrated manner, to attain sustainable crop production with minimal impact effect of chemical fertilizers on soil health and least disturbance to soil environment. Organic manure has been recorded to enhance the efficiency and reduce the requirement of chemical fertilizers. Partial nitrogen substitution through organic manure recorded significant superiority in yield over farmer's practice [2]. The impact of increased use of inorganic fertilizer in crop production has been large and important [3]. Organics supply nutrients at the peak period of absorption, but also provides micro nutrients and modifies soil- physical behavior as well as increase the efficiency of applied nutrients [4] and there by productivity of crops. Integrated use of chemical fertilizers, manures and such other inputs have shown positive and encouraging results in enhancing rice productivity in a sustainable and eco friendly manner. For sustainability in crop production, it is neither chemical fertilizer nor organic manures alone but their integrated use has been observed to be highly beneficial [5]. Taking cognizance of such studies, the present investigation was conducted at Telbal area of district Srinagar (J&K) to study the comparative use of integrated nutrient management on vegetative growth and yield of hybrid rice (Pant Sankar Dhan-3) during summer 2015.

Objectives of the investigation

1. To evaluate the direct effect of integrated Nutrient management on hybrid rice.
2. Assessment of benefit- cost ratio in terms of yield

II.METHODOLOGY

The experiment was laid out in Randomised Complete Block Design having 3 replications with 10 treatments. Prior to rice cultivation soil samples were collected at the depth of 0.30 cm, dried and ground and passed through 2 mm sieve and analyzed for various physio-chemical properties. The data on various growth and yield attributes, grain and straw yield were recorded for each treatment. The cost benefit ratio (CBR) was also worked out for different treatment modules.

Treatment module detail	
Treatment ₁ (T ₁)	Absolute control
Treatment ₂ (T ₂)	NPK 100% of recommended dose ha ⁻¹
Treatment ₃ (T ₃)	NPK 75% of recommended dose ha ⁻¹
Treatment ₄ (T ₄)	NPK (50%) + FYM @ 10.0 t ha ⁻¹
Treatment ₅ (T ₅)	NPK (50%) + FYM @ 15.0 t ha ⁻¹

Treatment ₆ (T ₆)	NPK(50%) + wheat straw @ 15.0t ha ⁻¹
Treatment ₇ (T ₇)	NPK(50%) + Neem cake @ 5.0 t ha ⁻¹
Treatment ₈ (T ₈)	NPK (50%) +vermicompost @ 2.5 t ha ⁻¹ +Azotobactor
Treatment ₉ (T ₉)	NPK (50%) + Vermicompost @ 2.5 t ha ⁻¹ + PSB@5.0 kg ha ⁻¹
Treatment ₁₀ (T ₁₀)	NPK (50%) + Neem cake @ 2.5 t ha ⁻¹ + FYM @5.0 t ha ⁻¹ + PSB @ 5.0 kg ha ⁻¹ + Azotobactor

III.RESULTS AND DISCUSSION

Treatment T₇ (NPK(50%) + Neem cake @ 5.0 t ha⁻¹) exhibited maximum plant height, followed by T₁₀(NPK (50%) + Neem cake @ 2.5 t ha⁻¹ + FYM @5.0 t ha⁻¹ + PSB @ 5.0 kg ha⁻¹ + Azotobactor) and lowest in T₁. The enhancement in growth with increase in fertility was owing to rapid conversion of synthesized photosynthates into protein to form more protoplasm, thus increasing the number and size of cell, which might have increased the plant height [6]. Highest number of panicles m⁻² (405) were recorded when the crop was fertilized with NPK (50%) + Neem cake @ 2.5 t ha⁻¹ + FYM@5.0 t ha⁻¹ + PSB @ 5.0 kg ha⁻¹ + Azotobactor (T₁₀) and the lowest number of pannicles (302) m⁻² were recorded in T₁(table 1). The highest nutrient uptake was in T₁₀ in which organic and inorganic sources of nutrients NPK (50%) + Neem cake @ 2.5 t ha⁻¹ + FYM@5.0 t ha⁻¹ + PSB @ 5.0 kg ha⁻¹ + Azotobactor were applied which was at par with T₇ (NPK(50%) + Neem cake @ 5.0 t ha⁻¹). The lowest uptake of total nitrogen, Phosphorus and potassium was found under T₁ (control followed by T₃ (NPK 75% of recommended dose ha⁻¹) (Table 1). This might be due to the realization of higher yield with organic sources. As application of FYM might have modified the physical condition of the soil and helped in its absorption and translocation from the soil.

Treatments	Plant height (cm)	No. of Pannicles (m ²)	1000 gram weight (g)
Treatment ₁ (T ₁)	94	302	16.7
Treatment ₂ (T ₂)	102	360	19.5
Treatment ₃ (T ₃)	95	345	16.9
Treatment ₄ (T ₄)	105	345	21.0

Treatment₅ (T₅)	110	345	20.1
Treatment₆ (T₆)	104	300	18
Treatment₇ (T₇)	117	333	23.2
Treatment₈ (T₈)	101	352	20.0
Treatment₉ (T₉)	101	354	22.0
Treatment₁₀ (T₁₀)	112	405	25.2

Table 1: Effect Of Integrated Nutrient Management On Yield Attributes Of Hybrid Rice During 2015.

Highest grain yield of 68 q ha⁻¹ was recorded in treatment NPK (50%) + Neem cake @ 2.5 t ha⁻¹ + FYM @5.0 t ha⁻¹ + PSB @ 5.0 kg ha⁻¹ + Azotobactor (T₁₀) followed by NPK (50%) +FYM@15.0 t ha⁻¹ (T₅) i.e., 61.20 q ha⁻¹ (table 2). Increased activity of heterotrophic bacteria and fungi in soil, in turn increase the activity of soil enzymes responsible for the conversion of unavailable form of nutrients to available form [7] which reflect ultimately on the yield of rice. Similar result was also reported by Surekha [8]. The highest straw yield of 94.10 q ha⁻¹ was recorded in T₅ (NPK (50%) +FYM@15.0 t ha⁻¹), followed by T₁₀ 89.40 q ha⁻¹ and the lowest straw yield was recorded in T₁ (table 2).

Treatments	Grain yield (q ha⁻¹)	Straw Yield (q ha⁻¹)	Biological yield (q ha⁻¹)
Treatment₁ (T₁)	25.70	39.64	60.10
Treatment₂ (T₂)	56.10	70.90	124.1
Treatment₃ (T₃)	49.90	64.70	112.4
Treatment₄ (T₄)	63.50	68.60	140.00
Treatment₅ (T₅)	61.20	94.10	145.7

Treatment₆ (T₆)	62.60	69.60	139.8
Treatment₇ (T₇)	63.00	73.30	125.4
Treatment₈ (T₈)	59.20	71.80	136.6
Treatment₉ (T₉)	61.80	69.40	133.5
Treatment₁₀ (T₁₀)	68.00	89.40	149.2

Table 2: Effect Of Integrated Nutrient Management On Yield Of Hybrid Rice During 2015.

Treatment 5 (NPK (50%) + FYM@15.0 t ha⁻¹) recorded the highest straw yield of 94.10 q ha⁻¹ and was most economical in registering CBR of 1:1.6 followed by treatment module (T₄) comprising NPK (50%) + FYM @ 10.0 t ha⁻¹ (Table 3). Owing to the production and comparatively lower cost the net return were the highest under treatment (T₅) and lowest with NPK(50%) + Neem cake @ 5.0 t ha⁻¹ (T₇) and Absolute control (T₁) while all other treatments recorded almost similar net return value. Pandey et al. also reported similar results[4].

Treatments	Cost of cultivation (Rs/ha)	Net return (Rs/ha)	Benefit cost ratio
Treatment₁ (T₁)	47875.0	24293.0	0.4
Treatment₂ (T₂)	51642.0	70041.0	1.3
Treatment₃ (T₃)	50815.0	48054.0	1.0
Treatment₄ (T₄)	51628.0	73820.0	1.5
Treatment₅ (T₅)	52379.0	77973.0	1.6
Treatment₆ (T₆)	65128.0	59999.0	1.23
Treatment₇ (T₇)	125128.0	-19415.0	0.2
Treatment₈ (T₈)	55320.0	68621.0	1.3

Treatment₉ (T₉)	55288.0	68084.5	1.3
Treatment₁₀ (T₁₀)	88730.0	48786.6	0.7

Table 3: Benefit cost ratio of Hybrid rice during 2015

IV.CONCLUSION

The integrated use of chemical fertilizers, organic manures and bio-fertilizers exhibited maximum sustainability of hybrid rice as well as maintenance of soil fertility. Substitution of 50 % of NPK through 10 to 15 tones of FYM or integrated use of (NPK (50%) + Neem cake @ 2.5 t ha⁻¹ + FYM @5.0 t ha⁻¹ + PSB @ 5.0 kg ha⁻¹ + Azotobactor) in hybrid rice crop resulted into higher productivity of hybrid rice over application of 100% NPK through chemical fertilizers. The treatment module T₅ consisting of NPK (50%) + FYM@15.0 t ha⁻¹ was also the most effective treatment for causing increase in grain yield with higher returns than T₁₀.

REFERENCES

- [1] Prasad, B., Prasad, J. and Prasad, R. (1995). Nutrient management for sustained rice and wheat production in calcareous soil amended with green manures, organic manure and zinc. *Fertilizer News*. **40**(3):39-41.
- [2] Singh, P. and Gangwar, B. (2000). Nitrogen substitution through FYM in maize-wheat cropping sequence under irrigated conditions. *Proc. of International Conference on managing natural resources for sustainable agricultural production in the 21st century, New Delhi*. **3**: 881-882.
- [3] Hossain, M. and Singh, V.P. (2000) Fertilizer use in Asian Agriculture: implications for sustainable food security and environment. *Nutrient Cycle in Agro-ecosys*. **57**:155-169.
- [4] Pandey, N., Verma, A.K., Anurag and Tripathi, R.S. (2007). Integrated nutrient management in transplanted hybrid rice (*Oryza sativa*). *Indian J. Agron.*, **52**(1) 40-42.
- [5] Khan, A. R., Sarkar, S., Nanda, P. and Chandra, D. (2001). Organic manuring through *Gliricidia manculata* for rice production. *International Centre for Theoretical Physics (UNESCO & IAEA), Trieste, Italy. Int.. Rep. IC/IR/2001/10*: 1- 4.
- [6] Viridia, H.M. And Mehta, H.D. 2010. Integrated nutrient management in transplanted rice (*Oryza sativa* L.). *International Journal of Agricultural Sciences*. **6** (1) : 295-299.
- [7] Singh, Yogeswer, Singh C.S. Singh, T.K. and Singh J.P. (2006). Effect of fertilizer on productivity nutrient uptake and economics of rice (*Oryza sativa* L.). *Indian J. Agron*. **51**(4):297-300.
- [8] Surekha, K. (2007). Nitrogen release pattern from organic sources of different C:N ratios and lignin content and their contribution to irrigated rice (*Oryza sativa* L.). *Indian J. Agron*. **52** (3) : 220-224.