

Effect of nitrogen schedule and weed management practices on yield attributing characters and yield of transplanted hybrid rice (*Oryza sativa* L.)

Abstract

The experiment conducted during *kharif* season of 2018-19 and 2019-20 at student instructional farm of Chandra Shekhar Azad University of Agriculture and Technology Kanpur, to study on productivity and resource use efficiency of transplanted hybrid rice in relation to weed management and nitrogen application. The experiment was laid out in split-plot design keeping nutrient management practices, viz. N₁-150 kg Nitrogen ha⁻¹; 3 equal split application at transplanting, 25 and 45 DAT, N₂-150 kg nitrogen ha⁻¹; 4 equal split application at transplanting, 25, 45 and 60 DAT, N₃-180 kg nitrogen ha⁻¹; 3 equal Split application at transplanting, 25 and 45 DAT. N₄-180 kg nitrogen ha⁻¹; 4 equal Split application at transplanting, 25, 45 and 60 DAT in main plots, and weed management practices, viz. W₁- Un-weeded (weedy check), W₂- Two hand weeding at 20 and 40 DAT, W₃- Anilophos @ 0.40 kg *a.i.* ha⁻¹*fb* weeding by cono-weeder at 30 DAT, W₄-Pretilachlor @ 0.75 kg *a.i.* ha⁻¹*fb* weeding by cono-weeder at 30 DAT, W₅- Anilophos @ 0.40 kg *a.i.* ha⁻¹*fb* fenoxaprop-ethyl @ 80 g *a.i.* ha⁻¹ at 25-30 DAT and W₆- Pretilachlor @ 0.75 kg *a.i.* ha⁻¹*fb* fenoxaprop-ethyl @ 80 g *a.i.* ha⁻¹ at 25-30 DAT in sub plots with three replications. Significantly higher yield attributes and yield (62.14 q/ha) were found under N₄ treatment than others and was comparable with N₁. Similarly, highest yield attributing characters and grain yield (67.84 q/ha) of hybrid rice was noticed with W₂ treatment.

Keywords: Cono-Weeder, Fenoxaprop-ethyl, Pretilachlor, test weight and Yield,

Introduction:

Rice (*Oryza sativa* L.) is a most important cereal crop, grown under aquatic condition and mostly under submergence or variable ponding conditions. It belongs to family Poaceae (*Graminae*). It is a most important staple food of about more than 60% of total world population. About 90% of the world's rice is produced and consumed in Asia (FAO 2017). Rice is cultivated world-wide

over an area of about 163.20 million ha with an annual production of about 758.90 million tone. (503.80 million tons, milled basis) and productivity 4.60 ton per hectare in (Anonymous, 2017-18). About 90% of all rice grown in the world is produced and consumed in the Asian region. It accounts 43% of total food grain production and 55% of cereal production in the country. It is a high caloric food, which contain 75% starch, 6-7% protein, 2-2.5% fat, 0.8% cellulose and 5-9% ash. Rice production in India is an important part of the national economy. India is an important part of the national economy. Here the research problem should have been discussed. What was the problem? Low yield due to decline in soil fertility? Or inappropriate application of fertilizer?...etc. The present strategy of increasing food production essentially involves the balance use of fertilizer to rice, because all the varieties give their full yield potential with adequate supply of nutrients (Ref.). Among various essential nutrient elements the nitrogen plays very vital role for growth and metabolic process in rice plants.

Comment [D1]: Replace with a known researcher report.

Comment [D2]: Which country?

Nitrogen is also responsible for more leaf area and dry matter production due to higher rate of cell division and cell elongation. Inadequate nitrogen application adversely affects the grain production while excess nitrogen may lead to relatively higher crop growth. Significant increase in grain yield of rice has been reported up to 200 kg N ha⁻¹ (Subbaih *et al.*, 2001). The authors have to explain why they ignored P-prosperous and K-potassium application which are also amacro nutrients with many effects on growth and development of plants

Formatted: Font: Not Bold

Formatted: Font: Not Bold

** Mechanical weeding in transplanted rice, apart from manually, weeding is also done by using a mechanical hand weeder (rotating hoe or cono-weeder) with no herbicide use. This practice incorporates the weeds into the soil which serve as green manure. Moreover, mechanical weeding becomes less hard in successive years as skill is gained in the methods and as better implements is developed. It eliminates the use of herbicides hence providing health benefits for all concerned persons like the farm worker and the consumer there is no pollution of the environment and ground water found that among the weed management practices, mechanical hoeing using cono-weeder (twice at 15 and 30 DAT) reduced the total weed population and dry weight significantly at all the crop growth stages than weedy check but it was at par with sequential application of herbicides and also recorded maximum grain yield (pProductivity) over other treatments under Jammu region (Kumar *et al.*, 2010).

Comment [D3]: Before jumping to mechanical weeding, the author is suggested to describe the significance of weed problem in rice. The author is also required to include literature indicating the importance of considering environmentally friendly and sustainable weed management practices

Comment [D4]: Either paraphrase these content briefly or delete it.

Comment [D5]: Indicate what does DAT means in the bracket.

Timely weed control is imperative for realizing desired level of crop productivity. In transplanted rice, *Echinochloa colona*, *Echinochloa crus-galli*, *Ischaemum rugosum*, *Caesulia*

axillaris, *Commelina* spp., *Cyperus* spp. and *Fimbristylis milliacea* are found to be the major weeds (Ref.). The author has to include explanation on how much these weeds are competitive or damaging rice yield. If possible the author needs to include the yield loss assessment reports of these weeds on rice. Weed shift from grasses to non-grasses and annual sedges is being observed in transplanted rice fields due to continuous use of butachlor, anilofos and pretilachlor herbicides in most rice growing areas of the country. These herbicides provide effective control of annual grasses when applied as pre-emergence 3-4 days after rice transplanting (Ref.).

- What was the purpose of this study?

Comments:

- The research problem under the Introduction was not well described and synthesized
- Lacks coherence of ideas in sentence and paragraphing
- Requires additional 3-5 relevant literature with regard to the study
- Referencing problem
- Lacks objectives

Formatted: Font: (Default) Times New Roman, 12 pt, Font color: Text 1

Formatted: List Paragraph, Bulleted + Level: 1 + Aligned at: 0.75" + Indent at: 1"

Formatted: Font: Not Bold

Formatted: List Paragraph, Bulleted + Level: 1 + Aligned at: 0.75" + Indent at: 1"

Formatted: Font: (Default) Times New Roman, 12 pt, Font color: Text 1

Formatted: Font: Not Bold

Formatted: Font: (Default) Times New Roman, 12 pt, Font color: Text 1

Formatted: Font: (Default) Times New Roman, 12 pt, Font color: Text 1

Formatted: List Paragraph, Indent: Left: 1", First line: 0"

Material and method:

Experimental Site

The experiment was conducted during *kharif* season of 2018-19 and 2019-20 at student's Instructional farm, C.S.A. University of Agriculture and Technology, Kanpur Nagar (U.P.). The field was well leveled and irrigated by tube well. The farm is situated at main campus of the university, in the west northern part of Kanpur city under sub-tropical zone in vth agroclimatic zone (central plain zone).

Formatted: Font: Highlight

Edaphic Condition

The soil was moist, well drained with uniform plane topography. The soil of the experimental field was alluvial in origin, sandy loam in texture and slightly alkaline in reaction having pH 7.71

(1:2.5 soil: water suspension method given by **Jackson, 1973**), electrical conductivity 0.31 dSm^{-1} (1:2.5 soil: water suspension method given by **Jackson, 1973**), Organic carbon percentage in soil is 0.35 per cent (Walkley and Black's rapid titration method given by **Walkley and Black, 1934**), with available nitrogen 172.2 kg ha^{-1} (Alkaline permanganate method given by **Subbiah and Asija, 1956**), available phosphorus as sodium bicarbonate-extractable P was 12 kg ha^{-1} (Olsen's calorimetrically method, **Olsen et al., 1954**) available potassium was 156.4 kg ha^{-1} (Flame photometer method given by **Hanwey and Heidel, 1952**).

Detail of treatments and design

The experiment was conducted in split-plot design with ~~3~~three replications. The experiment comprised of ~~4~~four treatments in main plots, viz. N₁: $150 \text{ kg Nitrogen ha}^{-1}$; 3 equal split application at transplanting, 25 and 45 DAT, N₂: $150 \text{ kg nitrogen ha}^{-1}$; 4 equal split application at transplanting, 25, 45 and 60 DAT, N₃: $180 \text{ kg nitrogen ha}^{-1}$; 3 equal split application at transplanting, 25 and 45 DAT. N₄: $180 \text{ kg nitrogen ha}^{-1}$; 4 equal split application at transplanting, 25, 45 and 60 DAT in main plots, and 6 treatments in sub plot such as W₁: Un-weeded (weedy check), W₂: Two time hand weeding at 20 and 40 DAT, W₃: anilophos @ $0.40 \text{ kg a.i. ha}^{-1}$ ~~fb~~weeding by cono-weeder at 30 DAT, W₄: pretilachlor @ $0.75 \text{ kg a.i. ha}^{-1}$ ~~fb~~weeding by cono-weeder at 30 DAT, W₅: anilophos @ $0.40 \text{ kg a.i. ha}^{-1}$ fenoxaprop-ethyl @ $80 \text{ g a.i. ha}^{-1}$ at 25-30 DAT and W₆: pretilachlor @ $0.75 \text{ kg a.i. ha}^{-1}$ fenoxaprop-ethyl @ $80 \text{ g a.i. ha}^{-1}$ at 25-30 DAT.

Comments on treatments:

The treatment arrangement is not clear. I think it is difficult to standardize the treatments and their combination. The study shows the presence of two factors (Nitrogen levels and weeding) but in this treatment arrangement:

- The main plots have nitrogen levels and time of application (two factors)
- The subplots contains Different weed control methods and their time of application

Therefore, the author should answer what is the basis of assigning different levels of a given facto, e.g. different levels of time of application, weeding time and weeding control time?

Therefore, there is no way to standardize the treatment combinations with varied levels

Fertilizers application

Comment [D6]: What is fb?

Formatted: Highlight

Formatted: Font: Bold

Formatted: List Paragraph, Bulleted + Level: 1 + Aligned at: 0.29" + Indent at: 0.54"

Formatted: Font: (Default) Times New Roman, 12 pt

Formatted: Font: (Default) Times New Roman, 12 pt

After making the individual experimental unit smaller plot the recommended dose of fertilizer as per treatment was applied, The individual nutrients viz. N, P₂O₅, K₂O, Sulphur and Zinc was given in the form of Urea, DAP, MOP, elemental Sulphur, Zinc sulphate, were mixed in soil before sowing. The nitrogen was given as basal (as per treatment) and in three - four split doses as topdressing at different days of intervals.

Application of herbicide

The doses of herbicides were calculated as per treatments. The spray volume was calculated on the test run basis and was found 400 liters of water ha⁻¹. The desired rate of herbicides and water was calculated for each plot and applied using knap – sack sprayer fitted with flat fan nozzle. For weed free treatment, hand weeding at 20 and 40 days after transplanting was done to maintain weed free condition.

Data collection

Number of effective tillers hills⁻¹

Effective tillers were counted from sampled row of each plots and expressed as number of effective tillers per meter row length. How many plants were sampled?

Formatted: Highlight

Panicle length (cm)

Ten spikes were randomly selected from tagged plants in each plot and their length (cm) was measured from neck node to tip of the top most spikes and average panicle length was calculated.

Number of grains pPanicle⁻¹

The grains of twenty selected panicles were counted and averaged to get the number of grains panicle⁻¹.

Grain weight panicle⁻¹(g)

Ten randomly selected panicles were taken out from each plot and threshed and grain weight was taken (g panicle⁻¹).

1000 grain weight (g)

One thousand grains were counted from representative sample of each treatment drawn from winnowed and cleaned produce, and their weight was expressed in gram.

Grain yield (q ha⁻¹)

After threshing of net plot area of each treatment, the grain was separated from the straw and cleaned. The grain yield was recorded plot wise, adjusted at 14% moisture level and there after expressed in $q\ ha^{-1}$.

Straw yield ($q\ ha^{-1}$)

After threshing of net plot area of each treatment, straw yield was recorded plot wise by subtracting grain yield from bundle weight and thereafter expressed in $q\ ha^{-1}$.

Biological yield ($q\ ha^{-1}$)

All above ground plant parts harvested from net plot area were carefully bundled, tagged and taken to the threshing floor separately. The individual bundle was weighed after complete drying in the sun and the biological yield per plot was then converted into $q\ ha^{-1}$.

Harvest index (%)

The harvest index was computed in term of grain yield expressed as percentage of biological yield (straw + grain) based on the per hectare yields.

$$\text{Harvest index (HI)} = \frac{\text{Grain Yield}}{\text{Biological yield}} \times 100$$

Methods of data analysis??

Methods used to analyze the data, software applied, probability levels used for comparing means,...etc

Formatted: Font: 14 pt, Not Bold

Results and discussion:

Formatted: Font: 16 pt

Yield attributing characters

No. of effective tillers hills⁻¹.

The data pertaining to no. of effective tillers hills⁻¹ as influenced by nitrogen schedule and weed management treatments are presented in Table 1. Among nitrogen schedule, nitrogen application at 180 kg nitrogen ha⁻¹; 4 equal split application at transplanting, 25, 45 and 60 days after transplanting (N₄) produced maximum effective tillers hills⁻¹ which, was significantly superior to 150 kg nitrogen ha⁻¹; 3 equal split application at transplanting, 25 and 45 days after transplanting (N₁) and other nitrogen treatments, under pooled data of both the years. Sequential application of herbicides resulted in higher number of effective tillers hills⁻¹ compared to alone application of herbicides. Application of anilofos @ 0.40 kg a.i. ha⁻¹ fb fenoxaprop-ethyl @ 80 g a.i. ha⁻¹ at 30 days after transplanting (W₅) recorded maximum number of effective tillers hills⁻¹ which was

Comment [D7]: Was these time of nitrogen split application recommended by previous findings?

significantly superior to pretilachlor @ 0.75 kg *a.i.* ha⁻¹*fb* weeding by cono-weeder at 30 days after transplanting (W₄) under pooled of both the year data. The consequences of the current investigation are additionally in concurrence with the investigation of **Kumar *et al.*, (2005) and Alagesan and Babu (2011)**

Panicle length (cm).

Nitrogen application at 180 kg nitrogen ha⁻¹; 4 equal split application at transplanting, 25, 45 and 60 days after transplanting (N₄) produced maximum panicle length which was significantly superior to all nitrogen treatments at pooled data of both the years. Sequential application of herbicides resulted in more panicle length compared to alone application of herbicides. Application of anilofos @ 0.40 kg *a.i.* ha⁻¹*fb* fenoxaprop-ethyl @ 80 g *a.i.* ha⁻¹ at 30 days after transplanting (W₅) recorded maximum panicle length (29.32). The results of the present investigation are also in agreement with the findings of **Das *et al.*, (2012) and Alagesan and Babu (2011)**

No. of grains panicle⁻¹.

Amongst various nitrogen schedule, nitrogen application at 180 kg nitrogen ha⁻¹; 4 equal Split application at transplanting, 25, 45 and 60 days after transplanting (N₄) recorded maximum (97.79) number of grains panicle⁻¹ which was significantly superior to all nitrogen treatments. Under sequential application of herbicides treatments, anilofos @ 0.40 kg *a.i.* ha⁻¹*fb* fenoxaprop-ethyl @ 80 g *a.i.* ha⁻¹ at 30 days after transplanting (W₅) recorded maximum grains panicle⁻¹ (95.93) which was significant to pretilachlor @ 0.75kg *a.i.* ha⁻¹*fb* fenoxaprop-ethyl @ 80g *a.i.* ha⁻¹ at 30 days after transplanting (W₆) (94.03) during (pooled) both the year of experiment. These results also confirms the findings of **Rahman *et al.*,(2007), Devi and Sumathi (2011) and Manhas *et al.*, (2012).**

Grains weight panicle⁻¹ (g)

Among various nitrogen schedule, nitrogen application at 180 kg nitrogen ha⁻¹; 4 equal split application at transplanting, 25, 45 and 60 days after transplanting (N₄) recorded maximum (2.64) grain weight panicle⁻¹ which was significantly superior to all nitrogen treatments. However 150 kg nitrogen ha⁻¹; 3 equal split applications at transplanting, 25 and 45 days after transplanting (N₁) recorded (2.16) lowest value of grain weight panicle⁻¹ under pooled data of both the year of experiment. Among weed management, anilofos @ 0.40 kg *a.i.* ha⁻¹*fb* fenoxaprop-ethyl @ 80 g *a.i.* ha⁻¹ at 30 days after transplanting (W₅) recorded maximum grain weight panicle⁻¹ (2.54 g)

which was significantly superior to pretilachlor @ 0.75 kg *a.i.* ha⁻¹fb fenoxaprop-ethyl @ 80 g *a.i.* ha⁻¹ at 30 days after transplanting (2.37g)(W₆), and rest of herbicides treatments during (pooled) both the year of experimentation. The consequences of the current investigation are additionally in concurrence with the investigation of **Zaidi and Tripathi (2007)**, **Shi Li Hong *et al.*, (2010)** and **Hirzel *et al.*, (2011)**.

Test weight (g).

Nitrogen schedule, application of 180 kg nitrogen ha⁻¹; 4 equal split application at transplanting, 25, 45 and 60 days after transplanting (N₄) recorded maximum (27.61g) test weight which, was significantly superior to all nitrogen treatments, under pooled data of both the years. Under sequential application of herbicides treatments, anilofos @ 0.40 kg *a.i.* ha⁻¹fb fenoxaprop-ethyl @ 80 g *a.i.* ha⁻¹ at 30 days after transplanting (W₅), recorded maximum test weight (27.30g) which was statistically significant to all herbicide treatments. However, pretilachlor @ 0.75kg *a.i.* ha⁻¹fb fenoxaprop-ethyl @ 80g *a.i.* ha⁻¹ at 30 days after transplanting (W₆), statistically at par to anilofos @ 0.40 kg *a.i.* ha⁻¹fb weeding by cono-weeder at 30 days after transplanting (W₃) and pretilachlor @ 0.75 kg *a.i.* ha⁻¹fb weeding by cono-weeder at 30 days after transplanting (W₄), and weedy check (W₁), during experimentation. The results of the present investigation are also in agreement with the findings of **Yadav *et al.*, (2010)** and **Choudhary *et al.*, (2011)**.

Productivity parameters

Grain yield (q ha⁻¹).

Among nitrogen schedule, nitrogen application at 180 kg nitrogen ha⁻¹; 4 equal split applications at transplanting, 25, 45 and 60 days after transplanting (N₄) produced maximum grain yield which was significantly superior to all nitrogen treatment, under pooled data of both the years. The grain yield under N₄ treatment was found higher by 8.17%, 4.79%, 1.75%, over 150 kg nitrogen ha⁻¹; 3 equal split application at transplanting, 25 and 45 days after transplanting (N₁), 150 kg nitrogen ha⁻¹; 4 equal split application at transplanting, 25, 45 and 60 days after transplanting (N₂) and 180 kg nitrogen ha⁻¹; 3 equal split application at transplanting, 25 and 45 days after transplanting (N₃), respectively, under pooled data of experiment. Among herbicidal treatments, the maximum grain yield (65.99 q ha⁻¹) was recorded under, anilofos @ 0.40 kg *a.i.* ha⁻¹fb fenoxaprop-ethyl @ 80 g *a.i.* ha⁻¹ at 30 days after transplanting (W₅) which, was significantly superior to pretilachlor @ 0.75 kg *a.i.* ha⁻¹fb weeding by cono-weeder at 30 days

after transplanting (W_4). The consequences of the current investigation are additionally in concurrence with the investigation of **Singh *et al.*, (2008) and Haque and Haque (2016)**.

Straw yield ($q\ ha^{-1}$).

Nitrogen application at $150\ kg\ nitrogen\ ha^{-1}$; 3 equal split applications at transplanting, 25 and 45 days after transplanting (N_1) produced lowest straw yield. However, $180\ kg\ nitrogen\ ha^{-1}$; 4 equal Split application at transplanting, 25, 45 and 60 days after transplanting (N_4) produced maximum straw yield which was significantly superior to all nitrogen treatments followed by application of $150\ kg\ nitrogen\ ha^{-1}$; 3 equal split application at transplanting, 25 and 45 days after transplanting (N_3), under pooled data of both the years. Among sequential application of herbicides, the maximum straw yield recorded under anilofos @ $0.40\ kg\ a.i.\ ha^{-1}fb$ fenoxaprop-ethyl @ $80\ g\ a.i.\ ha^{-1}$ at 30 days after transplanting (W_5) which was significantly superior to anilofos @ $0.40\ kg\ a.i.\ ha^{-1}fb$ weeding by cono-weeder at 30 days after transplanting (W_3) and pretilachlor @ $0.75\ kg\ a.i.\ ha^{-1}fb$ weeding by cono-weeder at 30 days after transplanting (W_4) during pooled data of experiment. The results of the present investigation are also in agreement with the findings of **Kumar *et al.*, (2015) and Singh *et al.*, (2013)**.

Biological yield ($q\ ha^{-1}$).

The highest biological yield was recorded under nitrogen application at $180\ kg\ nitrogen\ ha^{-1}$; 4 equal Split application at transplanting, 25, 45 and 60 days after transplanting (N_4) which was significantly superior to all nitrogen treatments. Among weed management treatment two, hand weeding at 20 and 40 days after transplanting recorded significantly maximum biological yield. However, anilofos @ $0.40\ kg\ a.i.\ ha^{-1}fb$ fenoxaprop-ethyl @ $80\ g\ a.i.\ ha^{-1}$ at 30 days after transplanting (W_5) significantly at with pretilachlor @ $0.75\ kg\ a.i.\ ha^{-1}fb$ weeding by cono-weeder at 30 days after transplanting (W_4). Whereas, application of pretilachlor @ $0.75\ kg\ a.i.\ ha^{-1}fb$ fenoxaprop-ethyl @ $80\ g\ a.i.\ ha^{-1}$ at 30 days after transplanting (W_6) highly significant to anilofos @ $0.40\ kg\ a.i.\ ha^{-1}fb$ weeding by cono-weeder at 30 days after transplanting (W_3), under pooled data of both the years. These results also confirms the findings of **Jacob and Elizabeth (2005) and Aminpanah *et al.*, (2013)**

Harvest Index (%).

Nitrogen application at $150\ kg\ nitrogen\ ha^{-1}$; 3 equal split applications at transplanting, 25 and 45 days after transplanting (N_1) produced statistically highest harvest index. Lowest harvest index

(35.31) was recorded under 180 kg nitrogen ha⁻¹; 4 equal split application at transplanting, 25, 45 and 60 days after transplanting (N₄). Among weed management treatments, anilofos @ 0.40 kg a.i. ha⁻¹fb fenoxaprop-ethyl @ 80 g a.i. ha⁻¹ at 30 days after transplanting (W₅) and anilofos @ 0.40 kg a.i. ha⁻¹fb weeding by cono-weeder at 30 days after transplanting (W₃) recorded maximum harvest index in pooled data of both the year. However two hand weeded plot recorded (37.50) value of harvest index in pooled data of both the year. The consequences of the current investigation are additionally in concurrence with the investigation of **Duary et al., (2015) and Jaswal and Singh (2019)**.

Conclusion

In view of the above conclusion, it is recommended that nitrogen should be applied as 180 kg nitrogen ha⁻¹; 4 equal split application at transplanting, 25, 45 and 60 days after transplanting (N₄) in combination with application of anilofos @ 0.40 kg a.i. ha⁻¹fb fenoxaprop-ethyl @ 80 g a.i. ha⁻¹ at 30 days after transplanting (W₅) for better yield attributes and higher yield of transplanted hybrid rice.

References

1. **Alagesan, A. and Babu, C.R., (2011)**. Impact of different nitrogen levels and time of application on grain yield and yield attributes of wet seeded rice. *Int. J. Food. Agric. Vet. Sci*, 1(1), pp.1-5.
2. **Aminpanah, H., (2014)**. Effects of Crop Density and Reduced Rates of Pretilachlor on Weed Control and Grain Yield in Rice. *Romanian Agric Res*, (31)
3. **Aminpanah, H., Sharifi, P., Mohaddesi, A., Abbasian, A. and Javadi, M., (2013)**. Effect of pretilachlor rate on grain yield and weed biomass in two rice cultivars. *International Journal of Biosciences (IJB)*, 3(8), pp.150-158.
4. **Anonymous (2003)**. Eighteenth Annual Progress Report of All India Coordinated Research Programme on Weed Control. Visva Bharati, Sriniketan Centre.
5. **Anonymous, (2017-18)**. Directorate General of Foreign Trade (DGFT), Department of Revenue and World Trade Organization (WTO). Commodity Profile for Rice - April, 2017-18: 1-8.
6. **Chaturvedi, I., (2005)**. Effect of nitrogen fertilizers on growth, yield and quality of hybrid rice (*Oryza sativa*). *Journal of Central European Agriculture*, 6(4), pp.611-618.

7. **Chaudhary, S.K., Jha, S. and Sinha, N.K., (2011).** Influence of nitrogen and weed management practices on productivity and nutrient uptake of wet direct seeded rice. *ORYZA-An International Journal on Rice*, 48(3), pp.222-225.
8. **Das, T.K., Tuti, M.D., Sharma, R., Paul, T. and Mirjha, P.R., (2012).** Weed management research in India: An overview. *Indian Journal of Agronomy*, 57(3s), pp.148-156.
9. **Devi, M.G. and Sumathi, V., (2011).** Effect of nitrogen management on growth, yield and quality of scented rice (*Oryza sativa* L.) under aerobic conditions. *Journal of Research ANGRAU*, 39(3), pp.81-83.
10. **Duary, B., S. Roy Chowdhury and A. Mukherjee. (2009).** Effect of sole and sequential application of herbicides on weed growth and productivity of transplanted rice in the lateritic belt of West Bengal. In: National Symposium on weed threat to environment, biodiversity and Agriculture productivity, TNAU, Coimbatore. P-28
11. **Duary, B., Teja, K.C. and Soren, U., (2015).** Management of composite weed flora of transplanted rice by herbicides. *Indian J. Weed Sci*, 47(4).
12. **FAO-Food and Agriculture Organization (2017).** FAOSTAT Database FAO, Rome, fertilizer and weed management practices. *Pakistan Journal of Botany* 41(3): 1357- 1357.
13. **Hanway, J.J; and Heidel, H. (1952).** Soil analysis methods as used in Iowa State College, Soil Testing Laboratory. *Iowa Agriculture* 54: 1-31.
14. **Haque, M.A. and Haque, M.M., (2016).** Growth, yield and nitrogen use efficiency of new rice variety under variable nitrogen rates. *American Journal of Plant Sciences*, 7(3), pp.612-622.
15. **Hirzel, J., Pedreros, A. and Cordero, K., (2011).** Effect of nitrogen rates and split nitrogen fertilization on grain yield and its components in flooded rice. *Chilean Journal of Agricultural Research*, 71(3), p.437.
16. **Jackson, M.L. (1973).** Soil chemical analysis. Prentice Hall of India Pvt. Ltd, New Delhi.
17. **Jacob, D. and Syriac, E.K., (2006).** Performance of transplanted scented rice (*Oryza sativa* L.) under different spacing and weed management regimes in southern Kerala. *Journal of Tropical Agriculture*, 43, pp.71-73.

18. Jagadeesha, N., Shet, R.M., Gireesh, C., Sheshadri, T. and Lokesh, G.Y., (2009). Uptake of nutrients by rice and weeds of influenced by different weed management practices in drum seeded rice. *International Journal of Agricultural Sciences*, 5(2), pp.490-493.
19. Jaswal, A. and Singh, A., (2019). Effect of post emergence herbicide application on weed flora in transplanted basmati rice. *Plant Archives*, 19(1), pp.449-454.
20. Kumar, R.; Kumar, R. and Kumar, S.S.,(2005).Effect of nitrogen and potassium levels on growth and yield of hybrid rice. *Journal of Applied Biology*, 15(1): 31-34.
21. Kumar, J.; Singh, D.; Puniya, R. and Pandey, P.C., (2010). Effect of weed management practices on nutrient uptake by direct seeded rice. *Oryza*, 47:291-94
22. Kumar, S., Sinha, K.K. and Singh, D.,(2015). Crop establishment, fertility and weed management practices in scented hybrid rice. *Indian Journal of Weed Science* 47(2): 113-116.
23. Manhas, S.S., Singh, G., Singh, D. and Khajuria, V., (2012). Effect of tank-mixed herbicides on weeds and transplanted rice (*Oryza sativa* L.). *Annals of Agricultural Research*, 33(1&2).
24. Olsen, S.R, Cole, C.V., Watanable, F. S. and Dean, L. A. (1954). Estimation of available phosphorous in soil by extraction with sodium bicarbonate. *USDA, Cric.* 930:19- 23
25. Rahman, M.H., Ali, M.H., Ali, M.M. and Khatun, M.M., (2007). Effect of different level of nitrogen on growth and yield of transplant aman rice cv. BRR1 dhan32. *Int. J. Sustain. Crop Prod*, 2(1), pp.28-34.
26. Shi, L., Ji, X., Zhu, X., Li, H., Peng, H. and Liu, Z., (2010). A preliminary study on optimizing nitrogen fertilization amount at different phases to enhance the storage capacity of super hybrid rice. *Scientia Agricultura Sinica*, 43(6), pp.1274-1281.
27. Singh VP, Singh G and Singh M.(2004). Effect of fenoxaprop-pethyl on transplanted rice and associated weeds. *Indian Journal of Weed Science* 36(3&4): 190-192
28. Singh, P. and Singh, S.S., (2006). Effect of establishment method, fertility level and weed-management practices on aromatic rice (*Oryza sativa*). *Indian Journal of Agronomy*, 51(4), pp.288-292.

29. Singh, V.P.; Pal, B. and Sharma, Y.K., (2013). Response of rice to nitrogen and zinc application irrigated with saline water. *Environment and Ecology*, **31**(1A): 344-349.
30. Singh, S.P., Sreedevi, B., Kumar, R.M. and Subbaiah, S.V., (2008). Grain yield and economics of wet direct sown rice under different establishment methods and nitrogen schedules. *ORYZA-An International Journal on Rice*, **45**(3), pp.245-246.
31. Subbiah, B.V. and Asija, C.L. (1956). A rapid procedure for the estimation of available N in Soil. *Curr. Sci.* **25**:259-260.
32. Subbaiah, S.V.; Kumar, R.M.; Singh, S.P.; Rama Prasad, A.S., (2001). Influence of nitrogen levels as hybrid rice. *Oryza*, **38**(1&2): 38-41.
33. Walkley, A. and Black, C. S.A. (1934). Old piper, S.S. soil and plant analysis. *Soil Sci.* **37**:29- 38.
34. Yadav, A.S., Jaidev, H.R. and Upadhyay, M.K., (2010). Effect of nitrogen levels and plant geometry on growth, yield and root characteristics of hybrid rice (*Oryza sativa*). *Crop Res.*, **40** (3), pp.16-19.
35. Zaidi, S.F.A. and Tripathi, H.P., (2007). Effect of nitrogen levels on yield, N uptake and nitrogen use efficiency of hybrid rice. *Oryza-An International Journal on Rice*, **44**(2), pp.181-183.

Table no. 1 Effect of nitrogen schedule and weed management practices on yield attributing characters of transplanted hybrid rice.

| Treatments | No. of effective tillers hills ⁻¹ | Panicle length(cm) | No. of grain panicle ⁻¹ | Grain weight panicle ⁻¹ | 1000 grain weight (g) |
|------------|--|--------------------|------------------------------------|------------------------------------|-----------------------|
|------------|--|--------------------|------------------------------------|------------------------------------|-----------------------|

| | 2018 | 2019 | Pooled | 2018 | 2019 | Pooled | 2018 | 2019 | Pooled | 2018 | 2019 | Pooled | 2018 | 2019 | Pooled |
|----------------------|-------|-------|--------|-------|-------|--------|-------|-------|--------|-------|-------|--------|-------|-------|--------|
| N₁ | 12.88 | 13.13 | 13.00 | 26.89 | 26.97 | 26.93 | 88.01 | 87.70 | 87.85 | 2.15 | 2.16 | 2.16 | 25.96 | 26.12 | 26.04 |
| N₂ | 13.54 | 13.80 | 13.67 | 28.15 | 28.27 | 28.21 | 92.11 | 92.51 | 92.31 | 2.34 | 2.36 | 2.35 | 27.06 | 27.22 | 27.14 |
| N₃ | 13.91 | 14.18 | 14.04 | 29.04 | 29.16 | 29.10 | 95.01 | 95.43 | 95.22 | 2.49 | 2.52 | 2.50 | 27.12 | 27.45 | 27.28 |
| N₄ | 14.33 | 14.52 | 14.43 | 29.82 | 29.95 | 29.88 | 97.57 | 98.00 | 97.79 | 2.63 | 2.65 | 2.64 | 27.56 | 27.66 | 27.61 |
| | | | | | | | | | | | | | | | |
| S.Em. ± | 0.05 | 0.04 | 0.04 | 0.03 | 0.11 | 0.08 | 0.37 | 0.35 | 0.23 | 0.003 | 0.004 | 0.004 | 0.06 | 0.08 | 0.03 |
| CD at 5% | 0.16 | 0.15 | 0.13 | 0.12 | 0.39 | 0.30 | 1.30 | 1.24 | 0.81 | 0.011 | 0.016 | 0.016 | 0.21 | 0.27 | 0.11 |
| | | | | | | | | | | | | | | | |
| W₁ | 11.83 | 12.08 | 11.95 | 26.74 | 26.79 | 26.77 | 87.51 | 86.84 | 87.18 | 2.13 | 2.14 | 2.14 | 26.34 | 26.49 | 26.41 |
| W₂ | 14.76 | 15.04 | 14.90 | 30.18 | 30.31 | 30.24 | 98.74 | 99.18 | 98.96 | 2.69 | 2.72 | 2.71 | 28.24 | 28.33 | 28.29 |
| W₃ | 13.88 | 14.00 | 13.94 | 28.68 | 28.80 | 28.74 | 92.36 | 92.76 | 92.56 | 2.43 | 2.45 | 2.44 | 26.64 | 26.79 | 26.72 |
| W₄ | 13.34 | 13.60 | 13.47 | 27.78 | 27.90 | 27.84 | 90.89 | 91.28 | 91.08 | 2.28 | 2.30 | 2.29 | 26.54 | 26.70 | 26.62 |
| W₅ | 14.33 | 14.61 | 14.47 | 29.25 | 29.38 | 29.32 | 95.72 | 96.14 | 95.93 | 2.53 | 2.55 | 2.54 | 27.10 | 27.51 | 27.30 |
| W₆ | 13.84 | 14.11 | 13.98 | 28.23 | 28.35 | 28.29 | 93.83 | 94.24 | 94.04 | 2.36 | 2.38 | 2.37 | 26.69 | 26.85 | 26.77 |
| | | | | | | | | | | | | | | | |
| S.Em. ± | 0.050 | 0.057 | 0.049 | 0.097 | 0.109 | 0.112 | 0.36 | 0.35 | 0.31 | 0.009 | 0.009 | 0.009 | 0.10 | 0.10 | 0.09 |
| CD at 5% | 0.144 | 0.163 | 0.140 | 0.278 | 0.312 | 0.320 | 1.02 | 1.01 | 0.88 | 0.026 | 0.026 | 0.026 | 0.28 | 0.28 | 0.26 |

Table no.2 Effect of nitrogen schedule and weed management practices on yield and harvest index of transplanted hybrid rice.

| Treatments | Grain yield (q ha ⁻¹) | Straw yield (q ha ⁻¹) | Biomass yield (q ha ⁻¹) | Harvest index (%) |
|------------|-----------------------------------|-----------------------------------|-------------------------------------|-------------------|
|------------|-----------------------------------|-----------------------------------|-------------------------------------|-------------------|

| | 2018 | 2019 | Pooled | 2018 | 2019 | Pooled | 2018 | 2019 | Pooled | 2018 | 2019 | Pooled |
|----------------|-------|-------|--------|--------|--------|--------|--------|--------|--------|-------|-------|--------|
| N ₁ | 56.49 | 57.63 | 57.06 | 98.62 | 99.65 | 99.13 | 155.11 | 157.27 | 156.19 | 36.18 | 36.32 | 36.25 |
| N ₂ | 58.22 | 60.10 | 59.16 | 105.78 | 105.01 | 105.40 | 164.00 | 165.11 | 164.55 | 35.17 | 36.05 | 35.61 |
| N ₃ | 60.11 | 61.98 | 61.05 | 108.75 | 109.71 | 109.23 | 168.86 | 171.69 | 170.28 | 35.27 | 35.76 | 35.52 |
| N ₄ | 61.14 | 63.14 | 62.14 | 112.17 | 112.35 | 112.26 | 173.31 | 175.49 | 174.40 | 34.96 | 35.66 | 35.31 |
| | | | | | | | | | | | | |
| S.Em. ± | 0.09 | 0.12 | 0.10 | 0.31 | 0.36 | 0.27 | 0.71 | 0.64 | 0.51 | 0.08 | 0.08 | 0.08 |
| CD at 5% | 0.32 | 0.43 | 0.36 | 1.09 | 1.28 | 0.95 | 2.51 | 2.25 | 1.80 | N.S. | N.S. | N.S. |
| | | | | | | | | | | | | |
| W ₁ | 36.25 | 36.63 | 36.44 | 100.75 | 99.90 | 100.32 | 137.00 | 136.53 | 136.76 | 26.48 | 26.84 | 26.66 |
| W ₂ | 66.89 | 68.78 | 67.84 | 112.87 | 113.28 | 113.07 | 179.76 | 182.06 | 180.91 | 37.22 | 37.78 | 37.50 |
| W ₃ | 62.39 | 64.39 | 63.39 | 104.61 | 105.00 | 104.80 | 167.00 | 169.39 | 168.19 | 37.36 | 38.01 | 37.69 |
| W ₄ | 60.60 | 62.55 | 61.57 | 103.16 | 104.41 | 103.78 | 163.76 | 166.96 | 165.36 | 37.02 | 37.46 | 37.24 |
| W ₅ | 64.95 | 67.04 | 65.99 | 108.48 | 109.45 | 108.97 | 173.43 | 176.49 | 174.96 | 37.45 | 37.99 | 37.72 |
| W ₆ | 62.86 | 64.88 | 63.87 | 108.12 | 108.03 | 108.07 | 170.98 | 172.91 | 171.95 | 36.84 | 37.61 | 37.22 |
| | | | | | | | | | | | | |
| S.Em. ± | 0.22 | 0.24 | 0.20 | 0.40 | 0.40 | 0.35 | 0.61 | 0.66 | 0.71 | 0.13 | 0.16 | 0.13 |
| CD at 5% | 0.62 | 0.68 | 0.57 | 1.14 | 1.15 | 1.01 | 1.75 | 1.89 | 2.03 | N.S. | N.S. | N.S. |

N₁-150 kg Nitrogen ha⁻¹; 3 equal split application at transplanting, 25 and 45 DAT
N₂-150 kg nitrogen ha⁻¹; 4 equal split application at transplanting, 25, 45 and 60 DAT
N₃-180 kg nitrogen ha⁻¹; 3 equal Split application at transplanting, 25 and 45 DAT
N₄-180 kg nitrogen ha⁻¹; 4 equal Split application at transplanting, 25, 45 and 60 DAT

W₁- Un-weeded (weedy check)

W₂- Two hand weeding at 20 and 40 DAT

W₃- Anilophos @ 0.40 kg a.i. ha⁻¹ weeding by cono-weeder at 30 DAT

W₄- Pretilachlor @ 0.75 kg a.i. ha⁻¹ weeding by cono-weeder at 30 DAT

W₅- Anilophos @ 0.40 kg a.i. ha⁻¹ fenoxaprop-ethyl @ 80 g a.i. ha⁻¹ at 25-30 DAT

W₆- Pretilachlor @ 0.75 kg a.i. ha⁻¹ fenoxaprop-ethyl @ 80 g a.i. ha⁻¹ at 25-30 DAT

- The experiment was not well designed and there was a fault in designing the field experiment and execution. Therefore, incorrect planning the research study results inappropriate results and conclusion.
- The analysis should have analysis of variance for split plot
- There is no mean separation test

Formatted: Font: (Default) Times New Roman, 13.5 pt, Bold

Formatted: List Paragraph, Bulleted + Level: 1 + Aligned at: 0.25" + Indent at: 0.5"

Formatted: Font: (Default) Times New Roman, 13.5 pt, Bold