GROWTH AND YIELD PERFORMANCE OF IR-36 ON VARYING NPK FORMULATIONS: A COMPARATIVE STUDY

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ABSTRACT

The study was conducted to determine the best NPK formulations for IR-36 rice variety under UNP conditions in terms of growth and yield performance.

The Randomized Complete Block Design (RCBD) was employed in three replications using the following treatments: F0 (control), FI (25-25-25), F2 (60-25-25), F3 (75-25-25), F4 (100-25-25), F5 (025-25-25), and F6 (150-25-25).

The growth performance of the plants was evaluated in terms of initial height of plants after transplanting and final height of plants at maturity in centimeters. The yield component was evaluated in terms of average number of productive tillers/hill, length of panicle in centimeters, average number of filled grains per panicle, dry seed yield per plot in kilograms and computed yield per hectare and net return per hectare and per plot in pesos. Except for the different NPK formulations evaluated, all the recommended technology in rice production were employed. The data gathered were statistically analyzed using the analysis of variance and the different treatment means were further subjected to the Duncan's Multiple Range Test (DMRT) to test their significant difference.

Results of the study revealed that 150 kilograms of nitrogen with 25 kilograms each of phosphorous and potassium per hectare significantly outgrew the other treatments tested. Likewise, same formulation F5 (150-25-25) significantly outranked all the other treaments in terms of the average number of productive tillers per hill, average length of panicle, and average number of filled grains per panicle. It also gave the highest dry seed yield per plot and per hectare and highest computed net return per area cultivated. Hence, it is concluded that a formulation of 150-25-25 kilograms NPK per hectare (F5) is the best of all the treatments evaluated.

Therefore the above cited NPK formulation is recommended to be employed in growing rice under UNP soil and climatic conditions, specifically, for IR-36 rice variety.

INTRODUCTION

Rice *(Oryza sativa,* Linn) is the staple food for the Filipino people because about 80% of the country's population are eating rice.

The plant is an animal grass with round, hollow jointed culm with flat leaves and terminal panicle. It is grown in flooded as well as in non-flooded soils. Unlike other cereals, rice germinates and thrives in water because it can transport oxygen from the leaves to the submerged roots where oxygen is released during photosynthesis.

Aside from being used as human food, rice has varied uses. Rice hull is utilized for fuel in bakeries and restaurants; straw is primarily used as roughages for cattle raisers and planting medium for mushroom growers; and the starch is used in textile industries, laundry and pharmaceutical preparation of glucose.

Although self-sufficiency in rice had already been attained in our country, it is still desired to increase further the production not only for our domestic supply but also to increase the export demand/quota of the national government for dollar reserves. Such demand for increased production could be attributed to the adoption of recommended technology such as the use of improved seeds, thorough land preparation and the use of the right kind and amount of fertilizers.

IMPORTANCE OF THE STUDY

In most rice farms in Ilocos Sur, especially those in the vicinity of the University of Northern Philippines, irrigation water is scarce. Hence, rice production is made possible only through rainfed conditions which very often results to low yield.

Studies show that although the variety is high yielding if the fertility level of the soil is very low, the area could still be checked by choosing the right kind and amount of fertilizer to be applied to a certain rice variety especially in rainfed areas like in the UNP experimental farms.

Fertilizer application is necessary and beneficial to crop production. Like other crops, rice needs the various nutrients in a more readily available form to enhance its growth and development. The amount of nitrogen to be applied should be only at a required level because too much application may produce excessive vegetative growth that will eventually lower the yield. This study was conducted in order to verify the correct amount or rate of NPK to be used for rice in the UNP farms. The results will be disseminated to rice growers in the surrounding communities that have similar soil type.

OBJECTIVES OF THE STUDY

This study was conducted to detennine the best NPK formulation for IR-36 rice variety under UNP soil and climatic condition.

Specifically, it sought to answer the following questions:

1. Which of the different NPK formulations would best enhance the growth performance of rice plants as measured in terms of:

   a) initial height of plants just after transplanting in centimeters; and
   b) final height of plants at maturity in centimeters?

2. Which of the different NPK formulations would give the best yield performance of rice plants as measured in tenns of:

   a) average number of productive tillers per hill;
   b) average length of panicle in centimeters;
   c) average number of filled grains per panicle;
   d) average yield per plot in kilograms;
   e) computed yield per hectare in kilograms and cavans?

TIME AND PLACE OF THE STUDY

The experiment was conducted at the UNP Experimental Fann from June 23 to November 21, 1988.

MATERIALS AND METHODS

This section present the list of materials, supplies and equipment used, and procedures followed in the conduct of the experiment

Materials. The following materials, supplies and equipment were used in the conduct of the study.

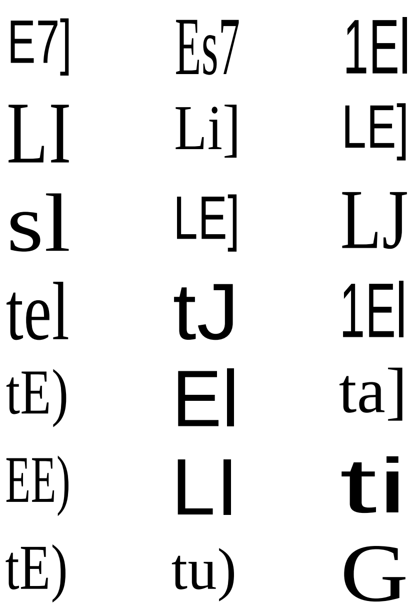
1. Experimental lot of 87.25 square meters
2. Seedlings of IR-36 rice variety
3. Draft cattle, plow and harrow
4. Urea (45-0-0) and complete (14-14-14) fertilizers
5. Insecticides
6. Fungicide
7. Knapsack sprayer
8. Meter stick
9. Weighing scale
10. Water pump and hose
11. Strings and pegs
12. Planting guide
13. Thresher
14. Placards and signboard
15. Winnowing basket, paper bags and sacks

Methods. The following methods and procedures were strictly followed and implemented in the conduct of the experiment for a more systematic gathering of the needed data:

I. *Raising of Seedlings.* Seedlings were raised in a wetbed. A I x 2 meter plot was thoroughly puddled then levelled. The seeds were soaked in water for 24 hours then pre-germinated for 36 hours in a shady place before they were sown in the prepared seedbeds at a unifonn rate of approximately *5* handful of seeds per square meter. After sowing, the seedbed was allowed to be saturated but not flooded during the first week. When the seedlings were about 2 centimeters in height, the seedbed was irrigated and gradually increasing the depth of water as seedling grew.

2. *Land Preparation.* The experimental area was irrigated then prepared thoroughly by alternately plowing and harrowing two times. The first plowing operation was done ten days before the scheduled time of transplanting. After the first plowing, the field was saturated with water for five days, before it was harrowed to further submerge the weeds to hasten decomposition. The second plowing operation was done after harrowing and then finally harrowed and puddled a day before transplanting.

3. *Experimental Design.* After puddling, the field was laid out in a Randomized Complete Block Design (RCBD). The experimental lot was divided into three blocks. Each block was further subdivided into seven plots measuring 1.5 x 1.5 meters each where the different treatment or NPK fonnulations (FO-control; F1-25-25-25; F2-50-25-25; F3-75-25-25; F4-100-25-25; F5-125-25-25 and F6-150-25-25 NPK per hectare) were distributed at random as shown in the layout.



4. *Transplanting.* The twenty-five day old seedlings were pulled from the seedbed a day before the scheduled transplanting time. Two seedlings were transplanted per hill in straight row at a distance of 20 x 20 centimeters making a total of 64 hills per plot. A marked stick was used as guide in transplanting.

5. *Fertilization.* Except for the control treatment (F0) all the other treatments basally applied with complete (14-14-14) fertilizer at the rate of 178.57 kg. per hectare or 40 grams per plot. The remaining amount of nitrogen was top dressed 30 days after transplanting using urea (45-0-0) for the treatments requiring additional amount of nitrogen as follows: FI (55.55 kg of urea/ha or 12.50 g/plot); F2 (HI.1l kg of urea/ha or 25 g/plot); F3 (166.66 kg of urea/plot or 37.5 g/plot); F4 (222.21 kg of urea/plot or 50 g/plot); F6 (277.76 kg. 0f urea/ha or 62.50 g/plot); and F7 (333.31 kg of urea/has or 75.00 g/plot).

6. *Irrigation and Drainage.* Dikes surrounding the experimental paddy were repaired well in order to hold rain water. An opening was made on the dike leading to the main canal in order to drain excess water during strong rain; thereby maintaining a depth of 3-5 cm. A water pump was used to supply water before harvesting and when the plants were at dough stage, the field was totally drained.

7. *Weeding.* Handpulling was employed in the control of weeds. Weeding was done two times at 15 and 30 days after transplanting.

8. *Spraying.* Thiodan, Decis and Benlate were alternately sprayed to the experimental plants. On a weekly interval starting from one week after transplanting to two• weeks before harvesting to protect the plants from the attack of pests and diseases.

9. *Harvesting.* The experimental plants were harvested 110 days after transplanting. The harvested grains were segregated by plots/treatments and threshed separately. The threshed palay were winnowed then dried under the sun for two consecutive days before they were weighed to determine the yield per plot.

10. *Gathering of Data.* Ten (10) hills were taken at random from the inner rows of each plot for the gathering of the following enumerated data.

    a. *Iriitial Height of Plants.* The initial height of plants was taken a day after transplanting (in centimeters). The sample plants were measured (in centimeters) from ground level up to the tip of the longest leaf with the use of a meter stick.

    b. *Final Height of Plants.* The final height of the experimental plants was taken a day before harvesting. Plants were measured from ground level up to the tip of the panicle.

    c. *Number of Productive Tillers.* The average number of productive tillers were counted. All tillers who produced panicle with filled grains were counted. The total was divided by the number of sample hills.

d. *Length of Panicle.* All the panicles of the productive tillers were measured in centimeters from base to the tip. The total length was divided by the number of panicles measured.

e. *Number of Filled Grains.* The average number of filled grains per panicle was determined by counting the number of filled grains used in taking the length. The total was divided by the number of panicles used.

f. *Dry Seed Yield Per Plot.* The average dry seed yield per plot in kilograms was determined by weighing the grains after threshing and drying with the use of Mitsubishi Weighing Scale.

g. *Computed Dry Seed Yield Per Hectare.* The yield per hectare in kilograms was determined based on the average dry seed yield per plot computed as follows:

$$\text{Yield/hainkg} = \frac{\text{Yield/plot(kg)}}{\text{Area/plot(sq.m.)}} \text{ x.Area/hectare}$$

h. *Net Return Per Plot and Per Hectare.* The computed net return per plot/hectare was computed as follows:

Net Return in Peso = Gross Sale-Expenses

11. *Analysis of Data.* Ali the data gathered were properly tabulated then analyzed using the analysis of variance (ANOVA). Means of the different treatments were further subjected to the Duncan's Multiple Range Test (DMRT) of significance at .05 and .01 levels.

DISCUSSION OF RESULTS

Growth

The first part of this study presents in textual and tabular forms the data gathered on the growth components of the plants.

Initial Height of Plants. The average initial height of plants in centimeters just after transplanting is presented in Table 1. As shown in the tabulated data in Table 1, *F5* (125-25-25 NPK/a) exhibited the tallest plants just after transplanting with a mean of 20.96 centimeters, followed by F2 (50-25-25) with a mean of 20.88 centimeters; F0 (control) and F6 (150-25-25) have the same means 20.86·centimeters. The shortest was exhibited by F3 (75-25-25) with a mean initial height of 20.74 centimeters.

Analysis of variance as shown in Table la revealed the insignificant difference among the means of the different treatments as shown by a computed F value of 0.09 which is lower than the tabulated F values of 3.00 and 4.82 in both levels. This was expected because the seedlings were just transplanted.

Table 1. Initial **Height of Plants After** Transplanting in Centimeters

Treatments	I	II	III	Total	**Mean**
F0 -Control	20.80	21.20	20.60	62.60	20.86
FI -25-25-25	20.80	20.30	21.10	62.20	20.75
F2 -50-25-25	21.50	21.04	20.10	62.64	20.88
F3 -75-25-25	19.90	20.90	21.42	62.22	20.74
F4 -100-25-25	21.02	20.75	20.60	62.37	20.79
F5 -125-25-25	20.94	21.20	20.7S	62.89	20.96
F6 -150-25-25	20.7S	21.10	20.70	62.55	20.86
Total	**145.71**	146.49	145.27		
Grand Total/Mean				437.47	20.83

Table 1a. ANOVA on the Initial **Height** of Plants

SV	**DF**	SS	MS	CFV	TFV .05	TFV **.01**
Block	2	0.1091	0.0546			
Treatments	6	0.1231	0.0206	0.09	3.00	4.82
Error	12	2.9039	0.2420			
Total	20	3.1361				

CV=2.36% Sx= 0.7840

Subjecting the different treatments and means to the Duncan's Multiple Range Test, as shown in Table lb, it is revealed that all the means of the different formulations were comparable as supported by common letters opposite their respective means. Results show that there was no effect yet of the different NPK formulations under study on the initial height of plants.

Table lb. DMR Test of Significance

Treatment	Mean
F0 (control)	20.86 a
FI (25-25-25)	20.73 a
F2 (50-25-25)	20.88 a
F3 (75-25-25)	20.74 a
F4 (100-25-25)	20.79 a
F5 (125-25-25)	20.96 a
F6 (150-25-25)	20.86 a

Means followed by common letter arc not significantly different at .05 lcvel.

Final Height of Plants. The average final height of plants in centimeters is presented in Table 2.

As shown in Table 2, F6(150-25-25 NPK/ha) exhibited the tallest plants at maturity with a mean of 99.07 centimeters. It was followed by F5 and F4 with mean final heights of 97.08 and 95.40 centimeters, respectively. The shortest was exhibited by the control treatment (F0) with a mean final height of 84.80 centimeters.

Table 2. Final Height of Plants at Maturity in Centimeters

Treatments	Block I	Block II	Block III	Total	Mean
F0	86.60	90.10	77.70	254.40	**84.80**
Fl	88.45	90.52	80.84	259.81	86.60
F2	94.60	96.18	84.J0	274.88	91.63
F3	95.41	95.70	88.75	279.86	93.29
F4	94.10	96.80	95.31	286.21	95.40
F5	95.30	98.22	97.73	291.25	97.08
F6	97.30	100.70	99.22	297.22	99.07
Total	**651.76**	**668.22**	**623.65**		
Grand Total/Mean				**1943.63**	**92.56**

Analysis of variance as revealed in Table 2a revealed a highly significant as revealed by the computed F value of 8.00 which is greater than the tabulated F values 0f 3.00 and 4.82 at .05 and .0I probability levels respectively. The result implies that plants applied with fertilizer significantly outgrew the control treatments as to the final height of plants.

Further subjecting the different treatment means to the Duncan's Multiple Range Test, means of Treatments 6, 5, 4 and 3 were not comparable or did not differ significantly with each other. Likewise, Treatment 2 is comparable with the means of F3, F4 and F5. Means of Treatments 0 and 1 were comparable with each other but found to be incomparable with the other treatments. Results show that plants applicd with 75 to 150 kgms. of nitrogen with 35 kg. of phosphorous and potassium **per** hectare significantly produced taller plants than those applied with lower rate of nitrogen. Results coroboratcd with the findings of Encarnacion (1969) that 200 kg of nitrogen per hectare gave significantly taller plants and greater yield.

Table 2a. **ANOVA**

SV	DF	S	MS	CFV	TFV .05	TFV .01
Block	2	145,1233	72.5617			
Treatment	6	504.2009	80.0335	8.00"	3.00	4.82
Error	12	120.0823	10.0069			
Total	20	769.4065				

Cv=3.32% Sx = 1.8264

Table 2b. DMR 'Test of Significance

Treatment	Mean
F0	84.80 **d**
Fl	86.60 cd
F2	91.63 bc
F3	93.29 ab
F4	95.40 ab
F5	97.08 ab
F6	99.07 a

Means followed by common letter are not significantly different at *.05* level.

Average Number of Productive Tillers Per Hill. The average number of productive tillers per hill is presented in Table 3.

As shown in Table 3, F6 produced the most number of productive tillers with a mean of 17.30 per hill, followed in descending order by FS, F4, F3, F2, FI and F0 with means of 16.37, 15.63, 14.43, 13.43, 12.80 and 10.73 productive tillers per hill, respectively.

The statistical analysis of data as shown in Table 3a revealed highly significant results with a computed F value of 14.37 which is higher than the tabulated F values of 3.00 and 4.82 at .05 and .01 probability levels, respectively. Results imply that the final height of plants was greatly influenced by the different NPK formulations tested. As the nitrogen was increased, there was a corresponding increase in the final height of plants.

Table 3. Average **Number** of **Productive** Tillers **Per Hill**

Treatments	BI o ck I	 II	 III	Total	**Mean**
F0	11.00	12.10	9.10	32.20	10.73
Fl	15.30	12.80	10.30	38.40	12.80
F2	14.30	14.40	11.60	40.30	13.43
F3	15.20	15.10	13.00	43.30	14.43
F4	15.70	17.00	14.20	46.90	15.63
F5	15.40	18.10	15.60	49.10	16.37
FG	16.50	18.60	16.80	51.90	17.30
Total	103.40	**108.10**	90.60		
Grand Total/Mcan				302.10	14.39

The Duncan's Multiple Range Test of significance as shown in Table 3b rcvcalcd that the mean of F6 is comparable to F5 and F4; F3 is comparable to F4 and F5; FI is comparable to F2 and F3, while the control treatment (F0) is incomparable to all the treatments applied with different NPK formulations. Results concurred with the findings of Romero (1986) that rice plants applied with 600 kg. of 14-14-14/ha produced the most number of productive tillers and highest yield per hectare.

Table 3a. ANOVA on the Average Number of Productive Tillers

SV	DF	SS	MS	CFV	TFV .05	TFV .01
Block	2	23.4372	11.7186			
Treatment	6	92.2124	15.3688	14.37	3.00	4.82
Error	12	12.8361	1.0697			
Total	20	128.4857				

CV= 7.19% Sx = 0.5971

Table 3b. DMR Test of Significance

Treatment	**Mean**
FO	10.73 £
Fl	12.80 de
F2	13.43 cde
F3	14.43 bcd
F4	15.63 lbc
F5	16.37 ab
F6	17.30 a

Means followed by common letters are not significantly different at .05 level.

Average Length of Panicle. The average length of panicle in centimeters is presented in Table 4.

As shown in the tabulated data, F6 produced the longest panicle with a mean length of 22.72 centimers, followed in descending order by F5, F4, F3, F2, FI and F0 with means of 21.73, 20.77, 20.39, 20.26, 20.14 and 18.92 centimeters, respectively.

Table 4. Average Length of Panicle in Centimeters

Treatments	Block I	Block II	Block III	Total	Mean
F0	18.74	18.80	19.25	56.79	18.92
F1	19.90	19.60	20.91	60.41	20.14
F2	19.60	19.70	21.48	60.78	20.26
F3	19.60	20.78	20.79	61.17	20.39
F4	20.20	21.30	20.82	62.32	20.77
F5	21.40	22.10	21.68	65.18	21.73
F6	21.90	23.45	22.82	68.17	22.72
Total	**141.43**	**145.73**	147.75		
Grand Total/Mean				**434.82**	20.71

Statistical analysis of the data as shown in Table 4b revealed a highly significant difference among treaments with a computed F-value of 16.29 which is very much greater than the tabulated F values of 3.00 and 4.82 at .05 and .01 level of significance. This implies that plants applied with higher N with equal amount of P and K produced significantly longer panicles than those with lesser amount and the control treatment

Table 4a. ANOVA

SV	DF	SS	MS	CFV	TFV .05	TFV .01
Block	2	3.0686	1.5343			
Treatment	6	26.6791	4.4466	16.29"	3.00	4.82
Error	12	3.2744	0.2729			
Total	**20**	**33.0221**				

CV=2.52% Sx = 0.3016

Further subjecting the different treatment means to the Duncan's Multiple Range Test as shown in Table 4b, F6 and F5 were comparable; F5 is also comparable to F4, F3, F2 and F1 as regards to the length of panicle in centimeters. The control treatment (F0) is not comparable to all the treatments applied with different levels of N, and with same level of P and K. Hence, it is concluded that higher rate of N applied will enhance the production of longer panicles.

Table 4b. DMR Test of Significance

Treatment	**Mean**
F0	18.92 c
Fl	20.14 c
F2	20.26 c
F3	20.39 c
F4	20.77 be
F5	21.73 ab
F6	21.72

Means followed by common letter are not significantly different at .05 level.

Average Number of Filled Grains. The average number of filled grains per panicle is presented in Table 5.

As shown in the tabulated data, F6 likewise registered the most number of filled grains per panicle with a mean of 115.97, followed by F5, F4, F3, F2, FI and F0 with means of 112.34, 108.53, 104.67, 101.40, 97.53 and 88.77 filled grains per panicle, respectively.

The analysis of variance as shown in Table 5a revealed highly significant results with a computed F value of 43.34 which is very much greater than the tabulated F values of 3.00 and 4.82 at both levels, respectively. This shows that plants applied with higher rate of NPK with equal amount of P and K tend to increase the number of filled grains per panicle. This is an evidence that N is needed not only for vegetative growth of plants but also for the development of filled grains.

Table 5. **Average** Number of Filled Grains Per Panicle

Treatments	I	**Block** II	III	Total	**Mean**
F0	80.80	95.10	90.40	266.80	88.77
Fl	93.60	101.80	97.20	292.60	97.53
F2	94.70	104.30	105.20	304.20	101.40
F3	96.30	108.30	109.42	314.02	104.67
F4	101.60	110.40	113.60	325.60	108.53
F5	108.70	113.00	115.32	337.02	112.34
F6	112.30	116.90	118.70	347.90	115.97
Total	**688.00**	**749.80**	**749.84**		
Grand Total/Mean				2187.64	104.17

Duncan's Multiple Range Test of Significance as shown in Table 5b revealed comparable means between F6 and F5; F5 and F4; F4 and F3; F3 and F2 and Fl and F2. However, the mean of F0 (control) is incomparable to the means of all treatments applied with different N levels and equal amount of P and K. This implies that regardless of soil type, it pays to apply inorganic fertilizer to supplement the nutrients already present in the soil in that area.

Table 5a. ANOVA

SV	DF	SS	MS	CFV	TFV .05	TFV .01
Block	2	363.9729	181.9864			
Treatment	6	1542.5493	257.0916	43.34"	3.00	4.82
Error	12	71.1758	5.9314			
Total	20	1977.6978				

CFV=2.34% Sx = 1.4061

Table **Sb. DMR** Test of Significance

Treatments	**Mean**
F0	88.77 **f**
Fl	97.53 **e**
F2	101.40 de
F3	104.67 cd
F4	108.53 be
F5	112.34 ab
F6	115.97 a

Means followed by common letters are not significantly different at .05 level.

Average Dry Seed Yield Per Plot. The average dry seed yield per plot in kilograms is presented in Table 6.

As shown in the table below, F6 registered the highest dry seed yield per plot with a mean of 1.72 kilograms; followed, in descending order by F5, F4, F3, F2, FI and FO with means of 1.62, 1.52, 1.35, 1.23, 1.03 and 0.90 kilograms per plot of dry seed yield respectively.

Table 6. Average Dry Seed Yield Per Plot in Kilograms

Treatments	Block I	II	m	Total	Mean
F0	0.88	0.92	0.90	2.70	**0.90**
Fl	0.97	1.02	1.10	3.09	1.03
F2	1.11	1.28	1.31	3.70	1.23
F3	1.30	1.36	1.38	4.04	*1.35*
F4	1.41	1.58	1.56	***4.55***	***1.52***
F5	1.58	1.64	1.65	**4.87**	1.62
F6	1.65	1.72	1.78	**5.15**	1.72
Total	**8.90**	**9.52**	**9.68**		
Grand Total/Mean				**28.10**	**1.34**

The analysis of variance in Table 6a revealed highly significant results as shown by a computed F value of 198.07 which is very much greater than the tabulated F values of 3.00 and 4.82, respectively both at levels of significance. It could be deduced from the table that as the rate of N was increased with equal amount of P and K, the higher is the average yield harvested per plot and that there is still a chance to increase because the yield has not decreased as reflected from the table. Hence, the control treatment was significantly outyielded by the plants applied with different NPK formulations.

Table 6a. ANOVA

SV	DF	SS	MS	CFV	TFV .05	TFV .01
Block	2	0.0485	0.0243			
Treatment	6	1.6634	0.2773	198.07°	3.00	4.82
Error	12	0.0162	0.0014			
Total	**20**	**1.7281**				

CV=2.79% Sx = 0.0216

Further subjecting the different means to the Duncan's Multiple Range Test of significance revealed that all the mean yield per plot of the different treatments were incomparable with each other. Results proved that as the amount of N increased, **a** corressponding increase on yield was obtained. Hence, the plants responded well to nitrogen application even exceeding the treatment of 60 kg N as used by Cornelio and Eugenio (1970).

Table 6b. DMR Test of Significance

Treatment	Mean
0	0.90 g
1	1.03 f
2	1.23 e
3	1.35 d
4	1.52 c
5	1.62 b
6	1.72 a

Means followed by common letters are not significantly different at .05 level.

Computed Dry Seed Yield Per Hectare. The computed dry seed yield per hectare in cavans is presented in Table 7.

As shown in the table, F6 (150-25-25) similarly gave the highest yield of 152.89 cavans, followed by F5 (125-25-25); F4 (100-25-25); F3 (75-25-25); F2 (50-25-25); FI (25,25-25); and F0 (control) with computed yield of 144.00; 135.11; 120.00; 109.33; 91.56and 80.00 cavans per hectare, respectively.

Based on the computed yield as shown in Table 7, IR-36 rice variety responded well under the soil condition of the university. Although the recommendations is 80 to 100-0-0/ha, it is still safe to increase the level of N with equal amount of 25 kg of r- and K per hectare in order to obtain higher yield.

Table 7. Computed Dry Seed **Yield Per** Hectare in Cavans

Treatments kg)	Yield/Plot (ca)	Yield/ha
F0 (control)	0.90	80.00
FI (25-25-25)	1.03	91.56
F2 (50-25-25)	1.23	109.33
F3 (75-25-25)	1.35	120.00
F4 (100-25-25)	1.52	135.11
F5 (125-25-25)	1.62	144.00
F6 (150-25-25)	1.72	152.89

Cost and Return Analysis Per Hectare. The cost and return analysis O study computed per hectare basis is presented in Table 8a and 8b and the corr net return.

As shown in the cost of production, F6 (150-25-25) registered the he computed cost of production of P8,780.70 per hectare while the lowest was re'st in the control treatment (F0) with a total expenses of P7,026.25 per hectare.

On the computed net return per hectare, F6 similarly registered the highest with PIO,330.40 and the lowest was likewise obtained in F0 with production cost of P2,973.75 to increase the nitrogen requirement of the soil especially if it is sandy in nature in order to obtain the highest net return on investment.

Cost and Return Analysis Per Plot. The cost and return analysis of the study per plot or an actual experimental area of *2.25* square meters is presented in Table 9a and b.

As shown in the cost of production, F6 registered the highest expenses of Pl.97 per plot and the lowest was observed in the control treatment (F0) with a production cost of PI.58 per plot. This was expected because the plants in F0 were not applied with fertilizer.

As regards to the computed net return, F6 similarly registered the highest net return of P2.33 per 2.25 square meters per plot and the lowest was obtained in F0 (control) with net return of P0.67 per plot. Again, it could be drawn from the data that as the nitrogen content of fertilizer applied was increased with equal amount of P and K a corresponding increase on the net return per unit area cultivated is noticeable.

Table 8. Cost and Return Analysis Per Hectare

A. Cost of Production

Treatments (1)	Nature of Cost (Pesos) Seeds 2)	Land Prep. 3)	Fertilizers (4)	Chemicals (5)	**Labor** (6)	**Misc.**	Total
F0 (control)	236.25	1,250.00		1,790.00	2,750.00	1,000.00	7,026.25
FI (25-25-25)	236.25	1,250.00	932.27	1,790.00	2,750.00	1,000.00	7,958.52
F2 (50-25-25)	236.25	1,250.00	1,096.74	1,790.00	2,750.00	1,000.00	8.122.99
F3 (75-25-25)	236.25	1,250.00	1,261.16	1,790.00	2,750.00	1,000.00	8,287.41
F4 (100-25-25)	236.25	1,250.00	1,425.59	1,790.00	2,750.00	1,000.00	**8,451.84**
F5 (125-25-25)	236.25	1,250.00	1,590.02	1,790.00	2,750.00	1,000.00	8,616.27
F6 (150-25-25)	236.25	1,250.00	1,754.45	1,790.00	2,750.00	1,000.00	8,780.70

(I) - Based at P350.00/kg.
(2)- 25 man/animal/day at P50.00 for two times plowing and harrowing
(3) - Bascd on P2I5.00/bag of 14-14-14 and PI48.00/bag of 45-0-0
(4)- Bascd on P36.00/liter of Decis; P300.00/liter of Tamaron; PI65.00/liter of Thiodan and PI20.00/package of Benlate
(5) - 50 man/day at P25.00 for spraying. fertilization, weeding. harvesting and threshing and *5* man/animal/day at P50.00 for hauling and storing.
(6) - Estimated Cost of snacks of workers.

Net Return

Treatments	Computed Yield per ha. kg)	Gross Sale' (P)	Total Cost of Production (P)	Net Return (P)
FO- (control)	4,000.00	10,000.00	7,026.25	2,973.75
FI - 25-25-25	4,577.78	11,444.45	7,958.52	3,425.93
F2 - 50-25-25	5,466.67	13,666.68	8,122.99	5,543.69
F3-75-25-25	6,000.00	15,000.00	8,287.41	6,712.59
F4 - 100-25-25	6,755.56	**16,888.90**	8,451.84	8,437.06
F5 - 125-25-25	7,200.00	18,000.00	8,616.27	9,383.73
F6 - 150-25-25	7,644.44	19,111.10	8,780.70	10,330.40

Based at P2.50/kg

Table 9. Cost and Return Analysis Per Plot

A. Cost of Production

Treatments	Nature of Cost (Pesos)						
	Seeds (I)	Land Prep. 2)	Fertilizers (J)	Chemicals (4)	Labor (5)	Misc. (6)	Total
F0 (control)	0.05	0.28		0.40	0.62	0.23	1.58
FI (25-25-25)	0.05	0.28	0.21	0.40	0.62	0.23	1.79
F2 (50-25-25)	0.05	0.28	0.25	0.40	0.62	0.23	1.83
F3 (75-25-25)	0.05	0.28	O.28	0.40	0.62	0.23	1.86
F4 (100-25-25)	0.05	0.28	0.32	0.40	0.62	0.23	1.90
F5 (125-25-25)	0.05	0.28	0.36	0.40	0.62	0.23	1.94
F6 (150-25-25)	0.05	0.28	0.39	0.40	0.62	0.23	1.97

B. Net Return

Treatments	Computed Yield per ha. kg.)	Gross Sale' (P)	Total Cost of Production (P)	Net Return (P)
F0 - (control)	0.90	2.25	1.58	0.67
FI -25-25-25	1.03	2.58	1.79	0.79
F2 - 50-25-25	1.23	3.08	1.83	1.25
F3-75-25-25	1.35	3.38	1.86	1.52
F4 - 100-25-25	1.52	3.80	1.90	1.90
F5 - 125-25-25	1.62	4.05	1.94	2.11
F6 - 150-25-25	1.72	4.30	1.97	2.33

FINDINGS

Based on the data gathered, the following were observed and noted:

1. Plants applied with 125-25-25 NPK per hectare (F5) exhibited the tallest initial of plants with a mean of 20.96 cm. while FI (25-25-25) registered the lowest with a mean of 20.73 cm.

2. Plants that were applied with 150-25-25 NPK/Aha (F6) gave the tallest plants at maturity with a mean of 99.07 cm. while the lowest was exhibited by the control treatment {F0) with a mean of 84.80 cm.

3. Plants applied with 150-25-25 NPK/ha **likewise** produced the most number of productive tillers with a mean of 17.30 per hill while the control (F0) registered the lowest with a mean of 10.73 productive tillers/hill.

4. Plants applied with 150-25-25 NPK/ha similarly produced the longest panicle with a mean of 22.72 cm. and the shortest was registered in the control treatment (F0) with a mean of 18.92 centimeters.

5. Plants applied with 150-25-25 NPK/ha also produced the most number of filled grains with a mean of 115.97 per panicle and the control treatment exhibited the lowest with a mean of 88.77 filled grains per panicle.

6. On the average dry seed yield per plot in kilograms, plants applied with 150-25-25 NPK per hectare similarly gave the highest with a mean of l.72 kilograms and the lowest was registered in the control treatment with a yield of 0.90 kilograms per plot.

7. Plants applied with the highest NPK formulation of 150-25-25/ha also gave the highest computed dry seed yield **per** hectare of 152.89 cavans while the lowest was produced by the control treatment with a computed yield of 80.00 cavans per hectare.

8. Plants applied with the highest NPK formulation of 150-25-25 NPK/ha similarly produced the highest computed net returns of Pl0,330.40 per hectare and P2.33 per plot while the lowest was registered in the control treatment (F0) with a computed net return of P2,973.75 per hectare and P0.67 per plot.

CONCLUSIONS

Based on the. findings of the study, the following conclusions arc drawn:

1. There was no significant difference on the initial height of plants just after transplanting. This was attributed to the fact that the plants were just transplanted, hence, they were more or less uniform in height.

2. Highly significant difference was observed among the different treatments on the final height of plants at maturity. This implied that the growth of plants was highly affected by the level of nitrogen applied per treatment.

3. Highly significant difference was observed among the different treatments on the average number of productive tillers produced per hill. This is implied that the higher the level of nitrogen applied, the longer the panicle produced.

4. Highly significant differences were observed among the different NPK formulations studied on the average length of panicle in centimeters. Similarly, as the rate of N was increased with equal amount of P and K, the longer the panicle produced.

5. On the average number of filled grains produced per panicle, highly significant differences among the treatments were observed which showed that the higher level of nitrogen with equal amount of P and K gave significantly more number of filled grains than those applied with lower level and those that were not applied at all

6. Highly significant differences were again observed among treatments of the average dry seed yield per plot in kilograms. This was expected because plants, which have· been applied with highest level of nitrogen significantly outyielded the rest of the other levels evaluated.

7. The highest computed dry seed yield per hectare was produced by plants applied with 150-25-25 NPK/ha because it produced the longest panicle, most number of filled grains and highest dry seed yield per plot in kilograms.

8. Plants applied with the highest NPK formulation per hectare (150-25-25) registered the highest computed net return per hectare and per plot because it gave the highest dry seed yield per unit area cultivated.

RECOMMENDATIONS

Based on the findings and conclusions made, the following recommendations an: advanced.

1. Under UNP conditions and other locations with similar soil and climactic types, IR-36 variety of rice should be applied with 150-25-25 NPK/hectare to produce the most number of productive tillers per hill, longest panicle and most number of filled grains per panicle.

2. A formulation of 150-25-25 NPKha should be applied to IR-36 to produce the most number of productive tillers per hill, longest panicle and most number of filled grains per panicle.

3. An NPK formulation of 150-25-25 per hectare should be applied to IR-36 to produce the highest yield per plot and per hectare.

4. Likewise, an NPK formulation of 150-25-25 per hectare should be applied to IR-36 to obtain the highest computed net return per area cultivated.

5. Higher rate of NPK should be tried on other soil types particularly on farmers' field to determine if there is still an increase on yield of the plants.

6. Similar study should **be** conducted using other IR rice varieties to have **a** basis of yield comparison and other agronomic characteristics under UNP conditions.

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