

## RESPONSE OF EIGHT UPLAND RICE (*Oryza sativa* Ln.) VARIETIES TO VARIOUS LEVELS OF NITROGEN FERTILIZATION

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In the past years, varieties of rice were classified according to the cropping systems and seasons under which they are grown. Hence, we have rice crops for regular and *palagad* croppings; rice for swampy and for lowland and upland cultures (Borja, Torres, and Octubre, 1952). With the development of new varieties, new methods in rice production had also been tried and developed; simultaneously, researches were conducted on upland rice varieties. In 1972, about 11% of the total rice area in the Philippines was planted with upland rice (Bureau of Agricultural Economics, 1973).

On the average, the yield from upland rice fields is from 15-16 cavans per hectare or 0.66 to 0.7 tons per hectare (Obias, 1972). However, the yield of upland rice maybe increased to 7 tons per hectare under ideal condition as reported by De Datta and Beachell (1972).

According to De Datta and Ross (1975), upland rice farms are not commonly fertilized as lowland rice fields are. De Datta and Gomez (1974) also reported that high yields had been generally obtained from crops which high fertilization rates. Ishizuka (1974) observed the different responses of the rice plants to nitrogen applied at different stages of growth. From the IRRI (1967) field study, there was a significantly higher concentration of nitro-

gen in the grain during the early application particularly at the booting and heading stages. Furthermore, modern varieties remove more than twice as much N and P as compared with the old varieties.

The study compared the growth performances of six experimental lines with 2 varieties of rice to various levels of nitrogen fertilization under the upland condition and determined which of the tested varieties produce the highest yield at MSU condition.

### Materials and Methods

A two-factor factorial experiment was laid out in randomized complete block design in 3 replications using 8 varieties of upland rice in 5 levels of nitrogen. The varieties, all procured from Musuan Central Experiment Station, were C 166-135, C 12-30, C 188-72, C 22, BPI 76 (NS), IR 869-314-2, IR 1545-339, IR 1529-667-2. The varieties and their important agronomic characters are all presented in Table 1. Nitrogen fertilization was applied at the levels of 0 (control), 30-60-0, 90-60-0, and 120-60-0 kg/ha. The fertilizer was "split" applied at 10, 35, and 65 days from sowing in band placement. The phosphorus fertilization was applied during planting time as basal fertilizer. The study was conducted at MSU, College of Agriculture research area from December, 1976 to May, 1977.

The area was plowed and harrowed. The grains were drilled manually at the rate of 75 kg/ha. Each plot measured 1.5 m wide and 4 m long. Each replication consisted of 5 rows spaced at 30 cm apart. Spraying with Furadan was done every two weeks at the recommended rate, while handweeding was conducted until sheafing stage. The data collected were growth duration, plant height, number of productive tillers per culm per 30-cm segment, grain yield, weight of 1000 grains, number of filled grains per plant, percentage of unfilled grains and harvest index.

## Results and Discussion

*Grain yield.* The highest grain yield in tons per hectare was obtained from C 22. The grain yield of the varieties, after the highest yielder, was not significantly different from each other (Table 2). The grain yield in tons per hectare was significantly increased by the nitrogen fertilization. The highest grain yield was acquired from the varieties with 120-60-0 level of nitrogen. It is because C 22 is resistant to drought and responds to nitrogen favorably. However, it was affected by sheath blight, rice blast and bacterial leaf streak. The application of 5 levels of nitrogen brought about an increase in grain yields. Grain yields increase as nitrogen levels increase. In other words, these modern varieties respond favorably to high levels of nitrogen. Moreover, appropriately split timed fertilization is necessary for high yields of up-land rice.

*Weight of 1000 grains.* The weights of 1000 grains of BPI 76 (NS), IR 879-314-2 and IR 1529-667-2 were not significantly different from either 1545-339 or C 22 and C 12-30. C 188-72 was not significantly different from either C 12-30, and C 22 or C 166-135 (Table 2). The weight of 1000 grains was significantly affected by the five levels of nitrogen. Varieties with 120-60-0 level of nitrogen were the heaviest. The heaviest weight of 1000 grains, IR 1545-339 and BPI 76 (NS), are both resistant to vegetative stress. The grain weight of 1000 grains increases up to a certain extent, depending on the characters of the variety. Applying N either during panicle initiation or early booting stage helps plant produce more and heavier grains per panicle.

*Number of filled grains per plant.* The highest number of filled grains per plant was harvested from C 188-72 (Table 2). However, the number of filled grains per plant of BPI 76 (NS) was not significantly different from either C 22 or C 166-135, C 12-30, IR 879-314-2 and IR 1529-667-2. The number of filled grains per plant was not significantly improved by the application of various levels of nitrogen.

*Harvest index.* IR 1529-667-2 was not significantly different from either IR 1545-339 or IR 879-314-2, BPI 76 (NS), C 22, C 188-72, and C 12-30. The harvest index of the crop was not significantly affected by the five levels of nitrogen (Table 2).

*Other agronomic characters.* The growth duration, average plant height, number of productive tillers per culm per 30-cm segment, and percentage of unfilled grains were not significantly influenced by the various nitrogen levels on the eight upland rice varieties (Table 2). All eight varieties had a longer growth duration from its expected maturity stage, extending over 25 days more. The upland varieties depend entirely on both amount and distribution of rainfall, however, and the April rains were low. Since these rice selections experienced moisture stress, height was reduced, flowering was delayed and many grains were unfilled.

## Conclusion

The best yields were obtained from C 22 and BPI 76 (NS) which matured from 130-140 days at 120-60-0 level of fertilization. Increased grain yield as a result of nitrogen application can be observed.

The heaviest and lightest 1000 grain weight was produced by the varieties with 120-60-0 nitrogen level. Applying nitrogen fertilizer before sowing and during panicle initiation on early booting stage will help the plant produce more and heavier grains per panicle.

**Table 1. Summary of Agronomic Characteristics of Promising Upland Selections**

Variety	Source	+Important Agronomic Characteristics
C 166-135	UPCA	Medium size, brown grains without awn, mature in 120-125 days
C 12-30	UPCA	Bearded brown caryopsis, mature in 120-125 days
C 188-72	UPCA	Light brown caryopsis, mature in 120 days
C 22	UPCA	Brown caryopsis, mature in 120-125 days
BPI 76 (NS)	UPCA	Small size, brown grains, awnless, mature in 120-125 days
IR 879-314-2	IRRI	Light brown, medium size grains, some are awnless, matures in 120-125 days
IR 1545-339	IRRI	Dark brown caryopsis with awn, mature in 115-118 days
IR 1529-667-2	IRRI	Light brown caryopsis, some with short awn, mature in 120-125 days

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**Table 2. Summarized Data on the Response of Eight upland rice varieties to Various Levels of Nitrogen Fertilization**

Variety (kg/ha.)	Growth Duration from Sowing to Heading days	Growth Duration from Sowing to Maturity days	Average Plant Height at Seedling Stage cm.	Average Plant Height at Heading Stage cm.	Average Plant Height at Maturity Stage cm.	No. of Productive Tillers per culm per 30-cm segment
C166-135	115.60	150.33	14.6	36.10	44.73	1.7
C12-30	108.87	148.00	20.1	45.77	51.70	1.6
C188-72	111.07	148.00	16.7	35.00	42.93	2.2
C22	108.24	147.00	18.1	43.57	48.93	2.3
BPI76 (NS)	117.47	151.00	17.0	35.40	47.50	1.7
IR879-314-2	114.67	151.00	15.4	35.13	39.20	1.9
IR1545-339	102.13	138.00	12.8	36.13	41.77	1.9
IR1529-667-2	117.27	155.33	14.7	32.23	38.13	1.4
C.V. (%)	38.37	.80	139.35	61.36	120.63	19.05
HSD (.05)	NS	NS	NS	NS	NS	NS
<b>Nitrogen</b>						
<b>(kg/ha)</b>						
0-00	113.25	149.33	14.9	29.70	37.38	1.6
30-60-0	111.17	148.75	16.0	36.21	41.53	1.7
60-60-0	111.46	147.54	16.2	37.39	44.43	1.7
90-60-0	111.12	147.92	17.0	42.55	49.84	1.8
120-60-0	112.54	146.33	16.6	41.14	48.66	1.7
C.V. (%)	38.37	.80	139.35	61.36	120.63	19.05
HSD (.05)	NS	NS	NS	NS	NS	NS

Table 2. (Continued)

	Grain yield	Weight of 1000 grains	No. of filled grains per plant	No. of Unfilled grains	Harvest Index
<i>Variety</i> (kg/ha)	<i>ton/ha.</i>	<i>gram</i>			
C 166-135	.350 <sup>b</sup>	18.6 <sup>d</sup>	100.4 <sup>c</sup>	20.0	31.37 <sup>a</sup>
C 1230	.333 <sup>b</sup>	20.1 <sup>bc</sup>	99.3 <sup>c</sup>	18.2	7.07 <sup>c</sup>
C188-72	.350 <sup>b</sup>	19.3 <sup>cd</sup>	194.0 <sup>a</sup>	17.1	9.17 <sup>c</sup>
C22	.407 <sup>a</sup>	19.9 <sup>bc</sup>	115.5 <sup>b</sup>	13.6	7.81 <sup>c</sup>
BPI 76 (NS)	.383 <sup>b</sup>	20.9 <sup>ab</sup>	108.5 <sup>bc</sup>	17.9	7.59 <sup>c</sup>
IR 879-314-2	.323 <sup>b</sup>	20.8 <sup>ab</sup>	100.0 <sup>c</sup>	14.3	7.43 <sup>c</sup>
IR 1545-339	.323 <sup>b</sup>	21.4 <sup>a</sup>	20.6 <sup>d</sup>	18.6	13.47 <sup>b</sup>
IR 1529-667-2	.367 <sup>b</sup>	20.4 <sup>b</sup>	98.2 <sup>c</sup>	16.6	9.81 <sup>bc</sup>
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C.V. (%)	.180	5.52	14.31	50.58	68.02
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HSD (.05)	0.42	.74	9.39	NS	3.70
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<i>Nitrogen</i>					
<i>(kg/ha)</i>					
0-0-0	.322 <sup>b</sup>	19.0 <sup>b</sup>	79.38	19.9	8.00
30-60-0	.335 <sup>b</sup>	20.61 <sup>ab</sup>	94.45	17.5	8.39
60-60-0	.335 <sup>b</sup>	19.56 <sup>b</sup>	88.83	18.7	7.42
90-60-0	.370 <sup>b</sup>	20.20 <sup>ab</sup>	105.85	15.7	9.62
120-60-0	.421 <sup>a</sup>	21.36 <sup>a</sup>	116.83	13.2	10.09
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C.V. (%)	.180	5.52	14.31	50.53	68.02
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HSD (.05)	.05	.903	NS	NS	NS
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