RICE EXPERIMENTATION IN PAPUA NEW GUINEA

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Rice research by the Department of Primary Industry was largely limited to Bereina, about 110 km north-west of Port Moresby, before 1970. Rainfall on the Bereina research station was of doubtful reliability, so the rice research was transferred to Bubia, a research station in the lower Markham Valley. Bubia, in fact, is much more central and able to serve all parts of the country. Currently, intensive research is being carried out in the Markham Valley and the East Sepik Province.

Early problems

Many of the varieties of rice first brought to this country were tall and therefore susceptible to lodging. El, a Javanese selection introduced to Papua New Guinea in 1940, was one of these varieties. It was grown extensively in the Sepik.

The presence of red rice (with different cooking qualities) in these varieties was also a drawback.

More recent introductions, recommendations

A limited number of newer varieties, developed at the International Rice Research Institute (IRRI) in the Philippines, were tested at Erap in the Markham Valley in the late 1960s. These gave high yields compared to the older ones. They responded to highly fertile soils by giving greater grain production, rather than greater leafy growth as had been the case with the old ones. Generally they showed marked resistance to lodging, mainly because they were shorter, but also due to their stronger stems. They were also not contaminated with red rice and lastly, they were non-photoperiodsensitive, flowering at a set period after planting irrespective of day length.

Out of these, Milfor 6 (2) (NG 6009 *) and B5580 A1-15 (NG 6010) were selected and grown at seven sites ranging from Dumpu in the Ramu Valley to Munum in the lower Markham Valley. Results were generally not good due to erratic rainfall at the onset of that particular wet season. (Also planting time was probably not ideal as has been observed since.) Other factors such as soil conditions, leptocorisa damage (particularly on Milfor which matured later than B5580 and consequently suffered from a build-up of the pest) and drechslera leaf spot contributed to poor yields. It was obvious that these factors had to be more fully appreciated before wide-scale rice production in the Markham Valley could begin.

Further introductions from IRRI, the Solomon Islands, Sri Lanka, the USA and Australia followed, and by the end of 1973-74 some 70 varieties had been tested at a number of sites under both irrigated and dryland conditions.

Selection was based on consistency in yield, relative short stature associated with resistance to lodging, resistance to pests and diseases as well as good milling and cooking quality. A number of varieties (e.g. IR5 and IR8—two of the so-called "miracle" rices) yielded well but were superseded or discarded because of inferior cooking qualities or particular susceptibility to certain pests and diseases.

The variety currently recommended, NG 6637 (referred to as 6637) was selected. It is an IRRI line (IR532-E-208), a sister line to the IRRI variety IR20. It has performed well under both dryland and irrigated conditions in the Markham Valley and under dryland conditions in the Sepik. It is superior to IR5 and IR8 in cooking quality, displays a tolerance to stem borer, and drechslera is not as evident as in other high-yielding types.

Variety 6637 has a medium growing period (4 to 4½ months) and grows to about 80 cm. It has consistently yielded around 5 000 kg/ha (up to 8 500 kg/ha on occasions) when irrigated, and around 4 000 kg/ha when grown under dryland conditions.

Other varieties are being introduced and compared with 6637.

This article describes some of the experimental work behind the recommendations given in the following article, "Rice-growing recommendations". This material was first circulated as Bubia Information Bulletin No. 16—Rice (17th March, 1975).

* NG . . . Papua New Guinea plant introduction number.

Sowing and seeding rate

An experiment carried out in the Markham Valley in 1974 indicates that optimum seeding rate can vary with variety and suggests that higher rates may be advantageous. This is illustrated in *Table* 1.

Fertilizer requirements

Nitrogen

Good responses to nitrogen (N) have been obtained with dryland rice in the Markham Valley and these are shown in *Table* 2.

Responses to N have occurred in the Sepik as well, and again they are more marked on grassland or previously cropped areas than on secondary bush land.

Very heavy applications (200 kg/ha and more) can cause lodging.

A trial on irrigated rice at Gabmazung, about 30 km west of Lae, compared yields obtained with N applied before puddling and N applied 19 days after puddling (*Table* 3).

These trials show that nitrogen should be added before puddling and suggest that under Gabmazung conditions 100 to 150 kg/ha are necessary.

Another trial looked at 60 and 120 kg N/ha as well as other nutrients on old paddies (14 crops) and new paddies (2 crops). In both cases the higher rate consistently outyielded the lower one but the additional response in the older paddy was much higher—26 % as compared to 9 % in the newer paddy. No response to phosphorus or potassium was obtained and no obvious deficiency noted. It is likely that a higher N rate than 120 kg is necessary.

Phosphorus

Additions of this nutrient have been shown to be essential with dryland rice at one site in the Markham Valley (Umi), beneficial at two others and possibly beneficial at another. Responses have not been obtained on heavier soils in the Cleanwater to Erap area. *Table* 4 shows additional responses to P with N, over N alone, at two sites.

On irrigated rice, one trial (at Gabmazung) using phosphorus and potassium showed no responses either on old or new paddies.

Further study of P rates and application methods is being carried out.

Other nutrients

It is now well established that periodic zinc (Zn) applications are necessary with irrigated rice, in parts of the Markham Valley at least. On relatively alkaline soils (pH 7.5. to 8.5) deficiencies of trace elements, especially Zn, are often likely. This is especially so if the irrigation water is high in bicarbonate, which can tie up trace elements. Of the potential water sources many are high in bicarbonate and have to be used with care.

Zn deficiency has been noted on sites as far apart as Bubia (10 km from Lae) and Cleanwater (70 km). Glasshouse and field work has shown that Zn deficiency is very much tied up with soil type, quality of the irrigation water and cultural practices, particularly between crops.

The severity of Zn deficiency varied—at Ganip and Cleanwater in recent trials Zn applications were essential while at Gabmazung responses were relatively slight.

It is emphasized that although Zn deficiency is a problem with irrigated rice the use of zinc sulphate has remedied this deficiency successfully at each site to date. Zn deficiency is much less likely with dryland rice and to date only slight symptoms at a limited number of sites have been noted and then only at the seedling stage.

Deficiencies of potassium and other nutrients have not been encountered with

***Table* 1.—Average yields (kg/ha) of four varieties at five sowing rates.**

Rate kg/ha	*NG 6628*	*NG 6624*	*NG 6637*	*NG 6924*	*Average*	*% increase over lowest rate*
30	2 005	2 960	2 975	3 725	2 915	
60	2 205	3 580	3 715	3 890	3 345	14.7
90	2 630	3 420	3 985	4 100	3 535	21.3
120	2 975	3 825	4 395	4 410	3 900	33.8
150	3 180	3 720	4 780	4 790	4 114	41.2

Table 2.—**Responses to N over 2 years in the Markham Valley.**

N rate kg/ha	*Yield kg/ha* 1971-72	1972-73 *Trial A**	1972-73 *Trial B †*
0	1 438		
56	2 431		
112	3 263		
168	3 746		
224	4 453		
280	4 474		
336	4 526		
448	4 725		
0		4 291	2 950
30		4 450	3 970
60		4 400	4 220
90		4 475	4 820
120		4 458	4 630
150		4 325	4 770

* Area previously sown to legumes.

† On grassland with a further application of N 2½ months after sowing.

Table 3.—**Comparison of yields with N applied before puddling (trial 2) and N applied 19 days after transplanting (trial 1).**

N rate kg/ha	*Trial 1 Yield kg/ha*	*N rate kg/ha*	*Trial 2 Yield kg/ha*
0	3 910	0	2 140
56	4 430	50	3 800
112	4 870	100	4 430
168	4 700	150	5 390
224	4 690*	200	5 390†
280	4 750*	250	5 480†
336	4 590*	300	5 020†
448	4 200*	400	5 230†

* Leaf hopper damage.

† Lodging.

either dryland or irrigated rice to date in the Markham Valley or Sepik.

Weedicides

A number of weedicides have been tested. Trials in the Markham Valley at two sites indicated that diuron (Diurex), linuron (Afalon) and amitrol (Amitrex) and controlled weeds equally well. Diuron was equally effective at rates of 1, 2, 4 and 8 kg active ingredient (a.i./ha when applied with 300 l/ha of water. The other pre-emergence weedicides were effective at 4 and 8 kg a.i./ha with amitrol showing some toxicity to rice seedlings at the highest rate.

A number of other weedicides were fairly effective in controlling weeds but they were either quite toxic to rice or the safety margin at the recommended rate was too small to recommend their use. These included alachlor (Lasso), propachlor (Ramrod), trifluralin (Treflan), chloramben (Amiben), dichlorobenil (Casoran), asulam (Asulox), Cobex and Bladex. Simazine (Simatox) caused severe damage to rice under trial conditions in 1973-74 and should not be used.

Postemergence spraying with propanil (Stam F34) was shown to be fairly effective at rates of 3, 4.5 and 6 kg a.i./ha regardless of whether the chemical was aplied 23, 30 or 37 days after sowing.

Table 4.—**Response to P with N at two sites.**

Treatment	*Yield kg/ha* *Umi*	*Ragiampum*
Control	1 682	2 480
N (100 kg/ha	2 207	3 400
N (100 kg/ha) + P (50 kg/ha)	5 118	4 260*

* This treatment suffered leaf hopper damage which reduced yields.