**Summary:** A mosaic disease of *Amaranthus gangeticus* characterised by mosaic mottling has been described. The causal virus has been transmitted by sap inoculation and by the vector, *Aphis gossypii* Glov. The virus infected *Nicotiana glutinosa*, *Petunia hybrida*, *Gomphrena globosa*, *Celosia cristata* and *Achyranthes aspera*. The virus was found to have a thermal inactivation point of 60°–65°C, dilution end point of 1:1,000 to 1:10,000 and longevity *in vitro* of 72 hours. This virus differs from the one described earlier by Govindaswamy *et al.* (1967).

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# Studies on Method of Nitrogen Application in Relation to Frequency of Irrigation for Rice

*by*

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**Introduction:** It has been established that improvement in crop yields can be brought about by judicious use of irrigation and N. N requirements of high yielding varieties of rice are high and it is important that fertilzer N is utilized efficiently. Sub-surface application (Abaichandani and Patnaik, 1959), placement through pellets (Vachani, 1952) and split application (Vachani and Mahapatra, 1959) have been found advantageous in lowland rice fields. Rajendraprasad *et. al.*, (1970) reported that application of N in two split doses gave higher yields in irrigated upland rice. Time of application for flooded rice on a heavy clay soil at the International Rice Research Institute, Philippines demonstrated that split application did not increase the yields of IR. 8 significantly over the application of N entirely at planting (Anon. 1968).

Besides proper application of N, irrigation practice also contributes to efficient utilization of N by rice plant. Irrigation of rice may be continuous flooding or by intermittent wetting. Generally at the time of top dressing N, a temporary drainage is provided in order to bring the fertilizer close to the soil particles to enhance nutrient absorption and to minimise loss through nitrification and denitrification. At the International Rice Research Institute, however, no higher yield was obtained from draining the field for top dressing over applying the fertilizer on as much as 5 cm of water (Anon. 1970).

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In order to study the efficiency of N application under different water management practices, a trial was conducted under the All India Coordinated Rice Improvement Project at the Paddy Breeding Station, Coimbatore during 1969 and 1970, the results of which are presented below.

**Materials and Methods:** The experiment as laid out with variety Jaya in a replicated Split-plot design and conducted for three seasoes during 1969 *kharif* (June to October), 1970 *rabi* (January to May) and *kharif*. Methods of N application viz., 120 kg N/ha all basal dressing and split application of 30+50+40 kg N/ha at planting, tillering and panicle initiation were the main treatments while reflooding at 1, 3, 5 and 7 days after N application formed the sub-plot treatments. Besides recording grain yield, 10 clumps from each plot were collecled at harvest time and ancillary characters, viz., number of panicles per square meter, panicle length and weight, spikelet number and sterility, 1000-grain weight, grain to straw ratio and height of plant were recorded. Grain yield data from each season were analysed statistically.

**Results and Discussion:** During 1969 *kharif* split application of N recorded significantly increased yield of 542 kg/ha over entire N applied at transplanting (Table 1). The yield differences between different times of reflooding were not

TABLE 1. *Grain yield in kg/ha - 1969 Kharif, 1970 Kharif and Rabi*

| Days of reflooding after 'N' application | 1969 Kharif | | 1970 Kharif | | | 1970 Rabi | | Mean of three seasons | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | All basal | Split | All basal | Split | Reflooding treatments | All basal | Split | All basal | Split | Reflooding treatments |
| 1. | 5334 | 5637 | 7050 | 7580 | 7315 | 6469 | 7052 | 6284 | 6756 | 6520 |
| 3. | 4941 | 5567 | 7308 | 7630 | 7469 | 6645 | 7058 | 6298 | 6752 | 6525 |
| 5. | 4865 | 5546 | 7268 | 7553 | 7410 | 6643 | 6904 | 6259 | 6666 | 6463 |
| 7. | 5089 | 5644 | 6940 | 7293 | 7116 | 6432 | 6911 | 6155 | 6616 | 6385 |
| Mean | 5057 | 5599 | 7142 | 7514 | 7328 | 6547 | 6981 | 6249 | 6698 | 6473 |
| C.D. (P=0.05) | | | | | | | | | | |
| Between | | | | | | | | | | |
| 1. Methods of N application | 361.5 | | 260 | | | NS. | | | | |
| 2. Reflooding treatments | NS. | | 162 | | | NS. | | | | |
| 3. Methods × Reflooding treatments | NS. | | 183 | | | NS. | | | | |

All Basal : 120 kg N/ha at planting SPLIT=30 kg N/ha at planting NS. Not significant
50 ,, at tillering
40 ,, at Panicle initiation

significant. The difference in yield between reflooding treatments was high under all basal application of nitrogen than in split application. Reflooding on alternate days recorded increased yield of 393 kg/ha over once in three days wetting under all basal application of N, whereas the differences in yield between similar treatments under split application of N was only 70 kg/ha. In *kharif*, 1970 also the trend was similar, with split application of N registering significantly higher yield of 372 kg/ha than all N applied at planting. The yield differences between reflooding treatments were statically significant. Reflooding once in three days after N application gave the highest yield and it was on par with reflooding once in five and alternate days. In *rabi* 1970 split application of N gave higher yield than all basal dressing although the difference in yield was not statistically significant. The average difference in yield was 434 kg/ha. The differences in yield between times of reflooding showed a slight trend towards lower yields with longer drainage period.

The mean data of three seasons presented in Table 1 show that split application of N gave an average yield increase of 449 kg/ha over the basal application. Similar results have been reported from Maruteru (Andhra Pradesh) and Pattambi (Kerala) (Anon. 1970). Since the soil at Coimbatore is of clay loam type and of medium texture, split application appears to be more desirable to supply N to a medium duration variety like Jaya. The soil is also of slightly alkaline nature with a pH of 8.2.

Reflooding on alternate days and once in three days after N application produced almost similar yields over the three seasons and there was a trend for lower yields with longer drainage period of five and seven days. Reflooding once in five days and seven days under split N application recorded lesser yield of 88 kg/ha and 140 kg/ha respectively than alternate wetting. The decrease in yield under different intervals of reflooding can mainly be attributed to N losses. These losses can occur through nitrification and subsequent denitrification and leaching after reflooding, both from added fertilizer or native N. N losses through volatilization of ammonia gas may also occour in soils with high pH values and free carbonate.

Summary of ancillary characteristics presented in Table 2 shows that split application of N increased the plant height, panicle per square meter, panicle length and spikelets number per panicle. These increases have contributed towards higher yield over all basal application of N.

Trials conducted at the Paddy Breeding Station, Coimbatore under the All India Coordinated Rice Improvement Project to investigate the efficiency of top-dressing N under different times of reflooding have led to the conclusion that for a medium duration variety like Jaya, split application of N at planting. tillering and panicle initiation is better than application of entire N as basal

TABLE 2. *Summary of ancillary characteristics – 1969 Kharif and 1970 Rabi and Kharif*

| Season | Time and rate of N application | | | Days of reflooding after top-dressing N | Plant Height (cm) | Panicles/ Sq. M | Panicle length (cm) | Spikelets per panicle | Spikelet sterility (%) | Panicle weight (gm) | 1000 grain weight (gm) | Grain/straw ratio | Days of maturity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Basal | Till-ering | Pan. Init. | | | | | | | | | | |
| Kharif 1969 | 120 | 0 | 0 | 1 | 84.2 | 323 | 20.7 | 86 | 19.7 | 1.67 | 29.3 | 0.74 | 130 |
| | | | | 3 | 80.0 | 329 | 20.6 | 92 | 20.0 | 1.87 | 29.4 | 0.67 | 131 |
| | | | | 5 | 82.0 | 358 | 20.5 | 87 | 24.0 | 1.72 | 28.2 | 0.69 | 131 |
| | | | | 7 | 83.0 | 341 | 20.8 | 83 | 21.1 | 1.87 | 29.2 | 0.71 | 130 |
| | 30 | 50 | 40 | 1 | 88.0 | 344 | 21.6 | 94 | 20.5 | 2.14 | 28.7 | 0.66 | 131 |
| | | | | 3 | 87.0 | 356 | 21.7 | 95 | 22.0 | 2.11 | 29.1 | 0.79 | 132 |
| | | | | 5 | 87.0 | 334 | 21.3 | 87 | 26 0 | 1.95 | 29.1 | 0 65 | 131 |
| | | | | 7 | 90.0 | 336 | 21.4 | 90 | 24.0 | 2.13 | 28.8 | 0 65 | 133 |
| Kharif 1970 | 120 | 0 | 0 | 1 | 82.0 | 425 | 22.2 | 82 | 10.8 | 2.68 | 29.6 | 0 64 | 135 |
| | | | | 3 | 80.8 | 362 | 21.9 | 83 | 10.8 | 1.78 | 29.8 | 0.83 | 135 |
| | | | | 5 | 81.0 | 405 | 23.0 | 94 | 10.0 | 1.76 | 29.3 | 0.68 | 135 |
| | | | | 7 | 81.4 | 326 | 22 6 | 100 | 10.4 | 1.76 | 29.4 | 0.71 | 135 |
| | 30 | 50 | 40 | 1 | 86.0 | 370 | 22.0 | 92 | 10.0 | 1.80 | 30 0 | 0.74 | 135 |
| | | | | 3 | 83.0 | 390 | 22.6 | 94 | 10.0 | 1.78 | 29.9 | 0.71 | 135 |
| | | | | 5 | 85.0 | 421 | 23.7 | 100 | 10.8 | 1.78 | 29.6 | 0.70 | 135 |
| | | | | 7 | 85.0 | 439 | 23.4 | 105 | 10.0 | 1.78 | 29.7 | 0.71 | 135 |
| Rabi 1970 | 120 | 0 | 0 | 1 | 82.0 | 271 | 21.9 | 108 | 7.0 | 2.31 | 28.9 | 1.10 | 137 |
| | | | | 3 | 81.0 | 312 | 21.7 | 101 | 11.0 | 1.93 | 27.0 | 1.13 | 137 |
| | | | | 5 | 79.0 | 333 | 22.1 | 90 | 9.0 | 2.13 | 28.4 | 1.09 | 138 |
| | | | | 7 | 81.0 | 313 | 21.8 | 93 | 9.0 | 2.11 | 28.7 | 1.09 | 140 |
| | 30 | 50 | 40 | 1 | 86.0 | 290 | 22.5 | 102 | 9.0 | 2.00 | 28.9 | 1.48 | 137 |
| | | | | 3 | 84.0 | 343 | 21.9 | 96 | 10.0 | 1.94 | 28.2 | 1.06 | 137 |
| | | | | 5 | 85.0 | 324 | 22.2 | 103 | 8.0 | 2.13 | 28.2 | 1.08 | 138 |
| | | | | 7 | 89.0 | 335 | 22.0 | 99 | 9.0 | 2.03 | 28.4 | 1.07 | 140 |

dose. Under Coimbatore conditions reflooding on alternate days gave similar yields as that of reflooding once in three days after N application and these were superior to reflooding intervals of five and seven days.

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