

Madras agric. J. 64 (11) : 719—722. Nov., 1977

A Study on the Foliar Application of Urea on Rice (*Oryza sativa* L.)

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Experiments conducted to find out the effect of foliar application of urea solution over the top dressing of urea revealed that the foliar application was an effective measure of increasing the crop yield compared to top dressing. The foliar application could save at least 25 per cent of the nitrogen requirement. Application of 50 per cent of N as basal dose and another 25 per cent of N as foliar spray of 2.5 per cent urea solution at maximum tillering stage and 50 per cent N as basal + 25 per cent as foliar spray of 10 per cent urea solution at maximum tillering stage gave higher yield than the rest. A concentration of 5 to 7.5 per cent of urea solution can be adopted using a high volume sprayer without any bad effect. Spraying of water was found to have some favourable effect in increasing the yield.

Foliar application of nutrients is a method adopted to feed the plants through the foliage. Most of the minor elements are fed through the foliage since they are required in small quantities and soil application may be a waste and not effective. Narayanan and Vinodini (1957) observed foliar application was effective and reported that the yield differences between soil and foliar applications were more pronounced. In sugarcane, Kannan and Ranganathan (1963) reported that foliar application improved the quality of juice and the yield obtained was normal even with lower quantity of fertiliser.

Foliar application of urea solution was adopted on different crops and with various concentrations. Venkateswaralu and Krishna Rao (1965) reported an average response of 15.7 kg/ha of N sprayed as urea. Bhaumik (1966)

reviewed and reported that foliar application was used on various crops like, sugarcane, wheat, rice, jute, tobacco and chillies to advantage. Experiments were conducted to find out the effect of foliar application of urea solution over top dressing of urea granules.

MATERIALS AND METHODS

Experiments were conducted at the Regional Agricultural Research Station, Aduthurai during 1973-74 in the first (Kuruvai) and second (Thaladi) seasons. Kannagi and Ponni rice varieties were grown as the test crops in the two seasons respectively. Ten treatments were tried with four replications.

The treatments were as follows :

T₁-50% as basal (soil) application +
50% N in two split doses as top

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dressing at maximum tillering and primordial stages.

T₂-Same as T₁ + water spray at maximum tillering and primordial stages.

T₃-50% N as basal (Soil) application + 25% N as foliar spray with 2½% urea solution at maximum tillering stage.

T₄-50% N as basal (soil) application + 25% as foliar spray at maximum tillering stage + 25% as foliar spray at primordial stage with 2½% urea solution.

T₅-Same as T₃ but the concentration of urea solution was 5%.

T₆-Same as T₄ but the concentration of urea solution was 10%.

T₇-Same as T₃ but the concentration of urea solution was 10%.

T₈-Same as T₄ but the concentration of urea solution was 10%.

T₉-Same as T₃ but the concentration of urea solution was 20%.

T₁₀-Same as T₄ but the concentration of urea solution was 20%.

Nitrogen, phosphorus and potassium were applied at the rate of 100 kg N/ha (full dose) in the form of urea, 22 kg P/ha in the form of super phosphate and 41 kg K/ha as muriate of potash. The entire quantity of P and K was applied as basal doses.

RESULTS AND DISCUSSION

Sahu and Lenka (1967) reported that the hydrolysis of urea to NH₃ + CO₂ may be a slow process and the NH₃ from the urea sprayed on the leaves is available at a slower rate than that is required. Therefore, the basal

application of 50 per cent of the N required as soil application is essential and the losses of nitrogen in the soil due to leaching and denitrification are made up by foliar spray to some extent. Soil application cannot be entirely dispensed with, but foliar sprays will be more useful than top dressing. Past works also reveal that total substitution of soil application with foliar sprays did not prove to be effective. The previous experiments at this research station (Anon) revealed that when the basal dressing was reduced from 50 per cent of N to 25 per cent N the yield was affected and, therefore, all the treatments in this experiment received 50 per cent as basal dressing.

The results of grain yield presented below indicated that variations due to different treatments were significant in the Kuruvai season.

| Treatment | Grain yield (kg/ha) | % Increase over control |
|--------------------------|---------------------|-------------------------|
| T ₁ (Control) | 3234 | 100 |
| T ₂ | 3822 | 118 |
| T ₃ | 4176 | 129 |
| T ₄ | 3763 | 116 |
| T ₅ | 3587 | 110 |
| T ₆ | 3410 | 105 |
| T ₇ | 3529 | 109 |
| T ₈ | 4292 | 133 |
| T ₉ | 3763 | 116 |
| T ₁₀ | 3941 | 122 |
| S.E. 165.63 | | |
| C.D. 480.57 | | |

In general, foliar application of N instead of top dressing was found to be effective and all the treatments involving foliar application gave higher yields than the control. Basal application of 50 per cent of total N was

found to be necessary in all the treatments. Sahu and Lenka (1967) reported that the application of 50 per cent as basal dose and the other 50 per cent of foliar spray was better than application of the entire N as basal dose or application of entire N as foliar spray.

Among the treatments T₂ had given the highest yield of 4292 kg/ha and was on par with treatments 3, 2 and 10. In treatment 3, 50 per cent of the N was applied as basal application and 25 per cent N as foliar spray of 2.5 per cent urea solution at maximum tillering stage. This indicates that there is a possibility of saving about 25 kg N/ha which when calculated on urea (45% N) basis comes to the tune of 55 kg/ha. A similar trend was also seen in treatments 5, 7 and 9. Yield increase in treatment 3 to the extent of 29 per cent over the control indicates the possibility of increasing the yield of rice by resorting to foliar application in the place of top dressing besides effecting an economy in N application to the extent of 25 per cent of the total.

During thaladi season, the foliar application did not give significant increase in yield due to frequent heavy rains which had nullified the effect of foliar spray.

The necessity of finding out the proper concentration enhanced because, a large volume of spray fluid had to be used for a very dilute concentration. Use of large volume of spray fluid will cause dripping of the solu-

tion from the leaves and become waste. If, on the other hand a high concentration is used the osmotic pressure of leaves may be affected and may cause scorching. In this experiment a high volume sprayer was used in all the cases. Slight browning of leaves was observed where urea solution of 10 per cent and 20 per cent concentrations was used. The plants recovered in 5 or 6 days and the final yield was not affected (Jothimoorthy *et al.* 1973) Therefore, a fair mean of 5 per cent to 7.5 per cent concentrations of urea solution can be adopted. Krishna Rao and Venkataswaralu (1962) tried from 0 to 12 per cent of urea solution and observed that non-protein nitrogen increased with increased concentration. Mahapatra and Sharma (1963) found that spraying at panicle initiation stage caused scorching of spikelets but no such effect was observed in the present experiments. Incidentally, in this experiment a strange result was obtained. In treatment 2, a water spray was given to the plants over treatment 1. The yield was increased by 18 per cent over the control. This may be due to the favourable change in the turgidity of the leaf.

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