

Evaluation of Non-edible Oil Cakes on the Uptake of Urea-N by Low Land Rice Crop*

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An experiment was conducted to study the efficiency of urea applied alone and with ether extracted and whole cakes. *Neem* oil *Karanja* and *Kokum* cake treated urea increased dry matter yield and N-uptake, while *mahua* cake with urea reduced yield. Ether extraction improved the performance of *mahua* cake as a nitrification inhibitor.

Nitrogen supply is controlled by several factors in soil. Availability of nitrogen would be drastically influenced under flooded rice conditions due to the losses through leaching and denitrification in light textured soils. Recently Mishra *et al.* (1975) reported that the *neem* cake reduces nitrification rate of ammonium sulphate at field capacity, but only ammonium oxidation was checked by its selective inhibitory effect on *Nitrosomonas* sp. In this study, five non-edible oil cakes, their extracts and residues have been evaluated for their effect on nitrogen supply to the rice crop from applied urea.

MATERIAL AND METHODS

A pot culture experiment was conducted employing 18 treatment combinations formed out of following sets.

- I. Control, Urea, *neem* coated urea
- II. Whole cakes (*Neem*, *Mahua*,

Karanja, *Kokum* and *Ratanjyoti*) with urea

III. Ether extracted cakes

IV. Urea coated with cake extracts

The experiment was conducted in glazed pots containing 1 kg of air dry 2 mm surface soil from the CRRI, Cuttack farm. Superphosphate and muriate of potash were applied to give 40 ppm each of P_2O_5 and K_2O to all the pots. Cake samples were mixed with the entire soil at the rate of 0.5 per cent of soil weight. The pots were then flooded upto 5 cm standing water and incubated. After one week of incubation, treatments were allotted to the pots with care to incorporate the materials upto a depth of 3-4 cm. Three week old rice seedlings were transplanted at the rate of 2 per pots. Plants were harvested at maturity. The yield of grains straw and roots were recorded and analysed for total N con-

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tent. The uptake of total N was computed for each pot.

Air dried 60 mesh sample of cakes were extracted with solvent ether. The extracted cakes and their extracts were analysed (Table 1).

Urea coating with cake extracts and neem oil

The cake extracts were dissolved in ethanol and appropriate volumes equivalent to the whole cakes at the rate of cake application were used for coating urea granules. Urea solution of 100 ppm N was oven dried at 50°C in petridish and cooled. Cake extract dissolved in ethanol was spread uniformly over the dry urea film and mixed well. Ethanol was removed by oven drying at 50°C for a few minutes. As a precaution, uncoated urea used in this experiment was also treated with both coated and uncoated urea.

RESULTS AND DISCUSSION

The comparative effect of whole cakes, extracted cakes ordinary urea and urea coated with *neem* oil on the dry matter yield and N-uptake of roots, straw and rough rice has been studied (Table 2 to 4). The yield of rough rice was significant at 5 per cent when urea was applied with *Karanja* and *Ratanjyoti* cakes as compared to urea alone (Table 2). Similar effect was noticed for *neem* oil coated urea. The extracted cakes significantly increased the yield of rice by about 25 per cent over that of whole non-extracted cake. On the other hand solvent extracts of *Karanja* did not have any beneficial effect. Urea coated with the extracts of different cakes also had

no effect except the *Kokum*. Urea coated with *Kokum* cake extract significantly increased the yield of rough rice as compared to the application of urea over both extracted non-extracted *Kokum* cakes. Panicles did not form in pots treated with *mahua* cake. Mishra *et al.* (1960) attributed this property of *mahua* cake to the presence of Saponin, a toxic alkaloid.

The uptake of N (Table 3) followed a closely similar trend as that of dry matter production. *Karanja* and *Ratanjyoti* induced more N uptake in various parts as compared to others or urea alone. The effect of urea coated with *neem* was similar to that of dry matter production. *Karanja* and *Ratanjyoti* induced more N uptake in various parts as compared to others or urea alone. The N uptake in the total dry matter was significantly reduced on application of *mahua* cake because of lack of sink (grains). Nitrogen however accumulated in the straw and root as indicated by the higher per cent of N (Table 4).

Bains *et al.* (1971), Mehta and Patil (1972), Mishra *et al.* (1975) related the beneficial effects of the cakes on the utilization of urea to their inhibitory action on nitrification. Saharwat (1977) reported that the *Karanja* a furanol flavonoid is responsible for inhibition of nitrification.

The non-edible oil cakes and their extracts appear promising materials but their effective use needs further investigation into their chemical constituent(s), if any, responsible for their inhibitory role.

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RESULTS AND DISCUSSION

The comparative effect of whole cakes, extracted cakes ordinary urea and urea coated with neem oil on the dry matter yield and N-uptake of roots, straw and rough rice has been studied (Table 2 to 4). The yield of rough rice was significant at 5 per cent when urea was applied with Karanja and Ratanjoli cakes as compared to urea alone (Table 2). Similar effect was noticed for neem oil coated urea. The extracted cakes significantly increased the yield of rice by about 25 per cent over that of whole non-extracted cake. On the other hand solvent extract of Karanja did not have any beneficial effect. Urea coated with the extracts of different cakes also had

TABLE 1. Properties of Ether extracted cakes and their extracts.

| Cakes | Extracted Cakes | | | Cake extracts (weight of cake = 200 g) | | | |
|--------------------|-----------------|------------|-------|--|-------------|-----------|------------------|
| | Total N (%) | Carbon (%) | C/N | Weight (g) | Volume (ml) | Yield (%) | Specific gravity |
| Neem | 1.76 | 26.25 | 14.91 | 1.878 | 2.0 | 0.939 | 0.939 |
| Mahua | 1.35 | 26.76 | 19.77 | 10.878 | - | 5.439 | - |
| Karanja | 2.63 | 26.92 | 10.23 | 6.984 | 7.0 | 3.492 | 0.997 |
| Kokum | 0.71 | 29.17 | 41.08 | 25.022 | - | 12.511 | - |
| Ratanjyoti | 3.15 | 29.32 | 9.33 | 2.421 | 2.0 | 1.210 | 1.21 |
| Control | | | | | | | |
| Physical condition | | | | | | | |
| Neem | | | | | | | Viscous liquid |
| Mahua | | | | | | | Semi solid |
| Karanja | | | | | | | Liquid |
| Kokum | | | | | | | Semi solid |
| Ratanjyoti | | | | | | | Liquid |

TABLE 2. Yield of dry matter, g/pot (Oven dry basis).

| Treatment Plant Parts | Whole cake + urea | | | | Extracted cake + urea | | | | Urea coated with cake extract | | | |
|-----------------------------|-------------------|-------|------|---------------------|-----------------------|-------|------|---------------------|-------------------------------|-------|------|---------------------|
| | Rough rice | Straw | Root | Total dry matter | Rough rice | Straw | Root | Total dry matter | Rough rice | Straw | Root | Total dry matter |
| Cakes | | | | | | | | | | | | |
| Neem | 7.5 | 7.6 | 3.1 | 18.2 | 7.0 | 8.6 | 3.2 | 18.8 | 5.9 | 7.3 | 3.2 | 16.4 |
| Mahua | a | 6.1 | 2.8 | 8.9 | a | 5.4 | 2.9 | 8.3 | 7.1 | 7.2 | 3.6 | 17.9 |
| Karanj | 10.0 | 11.5 | 4.0 | 25.5 | 10.2 | 13.4 | 5.1 | 28.7 | 5.4 | 8.3 | 3.0 | 16.7 |
| Kokum | 6.8 | 5.5 | 2.9 | 15.2 | 6.0 | 6.5 | 2.7 | 15.2 | 9.7 | 6.3 | 2.6 | 18.6 |
| Ratanjyoti | 8.6 | 10.2 | 3.6 | 22.4 | 10.8 | 12.6 | 3.4 | 26.8 | 6.1 | 7.0 | 3.4 | 16.5 |
| Neem oil coated urea | | | | | | | | | | | | |
| Urea | | | | | | | | | | | | |
| Control | | | | | | | | | | | | |
| L. S. D. (0.05) | | | | | | | | | | | | |
| (0.01) | | | | | | | | | | | | |

a = Absence of panicle formation

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TABLE 3. N uptake by different plant parts, mg N/pot (Oven dry basis).

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a ~~xxx~~ Absence of panicle formation

TABLE 4. Per cent Nin different plant parts (Oven dry basis). Pot culture experiment

| Treatment | Whole cake + urea | | Extracted cake + urea | | Urea coated with cake extract | |
|----------------------|-------------------|-------|-----------------------|-------|-------------------------------|-------|
| | Rough rice | | Rough rice | | Rough rice | |
| | Straw | Root | Straw | Root | Straw | Root |
| Cakes | | | | | | |
| Neem | 0.978 | 0.435 | 1.107 | 0.424 | 0.991 | 0.406 |
| Mahua | a | 0.830 | a | 0.685 | 0.980 | 0.374 |
| Karanj | 1.042 | 0.494 | 1.040 | 0.495 | 1.137 | 0.434 |
| Kokum | 1.078 | 0.449 | 1.008 | 0.475 | 1.043 | 0.459 |
| Ratanjyoti | 1.174 | 0.521 | 1.059 | 0.490 | 1.075 | 0.466 |
| Wajne | | | | | | |
| Neem oil coated urea | | | | | | |
| Urea | | | | | | |
| Control | | | | | | |
| L.S.D. (0.05) | | | | | | |
| (0.01) | | | | | | |

a = Absence of panicle formation