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NITROGEN LEVELS AND SOURCES ON HERB, OIL YIELD AND SOIL FERTILITY OF RAINFED PALMAROSA

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ABSTRACT

Field experiments were conducted during rabi seasons of 1992 - 1993, to 1994 - 1995 to study the effect of different N sources with various levels on the oil yield and soil fertility of palmarosa in vertisol under rainfed condition. The application of urea at 75 kg ha^{-1} registered the highest herb yield (10,606 kg ha^{-1}) and oil yield (392 kg ha^{-1}). The combined application of organic (FYM) and inorganic(urea) fertilisers to supply N in equal proportion at 100 kg ha^{-1} recorded the maximum oil recovery. Reduction in the herb yield was observed with the application of organic N source, The application of 75 kg N ha^{-1} recorded the highest available nutrients viz., N, P, and K in the soil.

KEY WORDS: N Level, N source, Herb yield, Oil yield, Soil Fertility, Palmarosa

Palmarosa (*Cymbogon martini*) is an aromatic and essential oil bearing crop, which is widely grown in varied agroclimatic conditions in India. Generally, the poor fertility status of the soils and erratic distribution of rainfall resulted in poor returns to the rainfed farmers. Thus the commercial value of crops like Palmarosa can be included in the rainfed cropping system to increase the income of the farmers. The low cost of cultivation, resistance to pest and diseases and drought tolerant nature of this crop lead to wider cultivation of this crop. Besides its use in perfumery, flavouring and cosmetic industries, it fetches foreign exchange through export. The herb yield of the crop can be increased with N fertilization. Very limited research was carried out with N requirement for this crop. Hence, this experiment was undertaken to study the effect of different sources and levels of N on the yield and soil properties of palmarosa under rainfed vertisol.

MATERIALS AND METHODS

Field experiments were conducted during the rabi seasons of 1992 - 1993, 1993 - 1994 and 1994 - 1995 with palmarosa at Agricultural Research Station, Kovilpatti. The soil (vertisol) of the experimental site had the following characteristics: heavy textured with clay 54.2 per cent, silt 20.8 per cent, sand 25.0 per cent, pH 8.0, Ec.0.30 dSm^{-1}, organic C.O. 40 %. The soil is low in available N (alkaline KMO4-N 92 Kg ha^{-1}), and P (olsen P - 6.0 kg ha^{-1}) and high in K (NH_4 OAc-K-358 kg ha^{-1}). The treatment structure composed of five levels of N (0, 25, 50, 75 and 100 kg ha^{-1}) which was applied as urea and in combination with FYM as organic source on equal N basis. The experiment was laid out in randomised block design with three replications. Basally half dose of N, along with full dose of Phosphorous and Potassium at 20 kg P ha^{-1} as single super phosphate and muriate of potash respectively were applied uniformly to all the plots. The remaining half of N as per treatments was applied to the ratoon crop immediately after the harvest.

Seeds at the rate of 12.5 kg ha^{-1} were mixed with 5 kg of wet sand and sown during last week of September (42nd standard week) in all three

years in rows with 30cm and plants with 15cm spacing. The seasonal rainfall during the cropping period (October to February) was 358mm, 466mm and 474mm during 1992-1993, 1993-1994 and 1994-1995 respectively. The average minimum and maximum temperature were 17.7°c and 30.1°c. First harvest of the herb commenced at 90 days after sowing. The ratoon crop was harvested after two months. Altogether, two cuttings of each crop were taken during one year and biomass yield was recorded. The oil from suitably chopped herb was distilled by steam distillation for 3-4 hours at a constant temperature of 70° C. The post harvest soil samples were taken from the experimental site, processed and analysed for available N, P and K by standard procedures.

RESULTS AND DISCUSSION

Herb Yield

Increasing N level regardless of N sources resulted in significantly increase in herb yield. The increase in herb yield with first increment of 25 kg N ha^{-1} was large and it decreased with each successive increment of Nitrogen (Table 1). The highest herb yield was recorded at 75 kg N ha^{-1} as urea, but it was on par with 100 kg Nha^{-1} which were 36 and 35 per cent yield increasing respectively over control. Significant increase in dry matter was also observed by Raghuwanshi *et al.*, (1997). The addition of N as inorganic fertilizers might have enhanced the availability of N resulted in higher N up take which could be attributed to the maximum herb yield (Kumar *et al.*, 1996 : Chitdeshwari *et al.*, 1997).

Incorporation of organic (FYM) and inorganic fertilizers (Urea) to supply 100 kg N ha^{-1} on equal N basis registered the herb yield of 9870 kg ha^{-1} which was found to be maximum among the different levels of combinations of organic and inorganic fertilizers tried.

The combined use of organic and inorganic N sources showed slight reduction in the yield as compared to the application of inorganic N source alone. The slow release of nitrogen from organic N source, through mineralization might be the reason for the reduction in the herb yield (Dehamethi *et al.*, 1996).

Oil yield and oil recovery

Application of N at various levels irrespective of the N source had significant effect on the oil yield. The highest oil yield of 39.2 kg ha^{-1} was obtained with the application of 75kg N ha^{-1} as urea which recorded 83% increase over without N (Table 2). Increased addition of N level appreciably increased the herb and oil yield of palmarosa (Arun prasad *et al.*, 1995).

Table 1. Effect of levels and sources of N on the herb yield of Palmarosa

Treatment	Herb yield (Pooled mean) (kg ha^{-1})	Increase over control (%)
0 kg N/ha (Control)	6,699	-
25 kg N/ha^{-1} as urea	8,509	21
50 kg N/ha^{-1} as urea	9,870	32
75 kg N/ha^{-1} as urea	10,606	36
100 kg N/ha^{-1} as urea	10,380	35
12.5 kg N/ha^{-1} as urea + 12.5 kg ha^{-1} as FYM	8,139	17
25 kg N/ha^{-1} as urea + 25 kg N ha^{-1} as FYM	8,925	24
37.5 kg N/ha^{-1} as urea + 37.5 kg N ha^{-1} as FYM	9,362	28
50 kg N/ha^{-1} as urea + 50 kg N ha^{-1} as FYM	9,870	32
CD (0.05)	487	

Table 2. Effect of levels and sources of N on the yield and oil recovery of Palmarosa

Treatment	Oil yield (kg ha^{-1})	Oil recovery (%)
0 kg N/ha (Control)	21.4	0.32
25 kg N/ha^{-1} as urea	29.7	0.35
50 kg N/ha^{-1} as urea	35.5	0.36
75 kg N/ha^{-1} as urea	39.2	0.37
100 kg N/ha^{-1} as urea	38.4	0.37
12.5 kg N/ha^{-1} as urea + 12.5 kg N ha^{-1} as FYM	29.3	0.36
25 kg N ha^{-1} as urea + 25 kg N ha^{-1}as FYM	33.0	0.37
37.5 kg N ha^{-1} as urea + 37.5 kg N ha^{-1} as FYM	34.7	0.37
50 kg N ha^{-1} as urea + 50 kg N ha^{-1}as FYM	37.5	0.38
CD (0.05)	1.0	0.01

Table 3. Effect of levels and sources of N on Post harvest soil fertility status.

Treatment	Available N (kg ha^{-1})	Available P (kg ha^{-1})	Available K (kg ha^{-1})
0 kg N/ha (Control)	94	7.6	237
25 kg N ha^{-1} as urea	100	8.0	249
50 kg N ha^{-1} as urea	106	8.4	272
75 kg N ha^{-1} as urea	124	9.6	296
100 kg N ha^{-1} as urea	117	8.9	278
12.5 kg N/ha^{-1} as urea + 12.5 kg N/ha^{-1} as FYM	96	8.1	249
25 kg N ha^{-1} as urea + 25 kg ha^{-1} as FYM	99	8.1	259
37.5 kg N ha^{-1} as urea + 37.5 kg ha^{-1}107 as FYM	8.3	263	
50 kg N ha^{-1} as urea + 50 kg N ha^{-1} as FYM	105	8.5	273
CD (0.05)	6	0.6	14

The oil recovery from the herb was influenced by N fertilization regardless of N source (Table 2). The results indicated that the combined application of organic (FYM) and inorganic fertilizers (Urea) to supply 100 kg N ha^{-1} on equal N basis registered the maximum oil recovery of 0.38%. The percentage of oil recovery increase over control was found to be 18.8%. Application of increasing levels of nitrogen showed an increasing of FYM increases the Palmarosa oil content was also reported by Muthuswamy *et al.*, (1995). The addition of FYM increased availability of Sulphur which could be contributed to the increased oil recovery percentage (Balasubramanian, 1997).

Soil fertility status

From the nutrient status of the soil, the post harvest stage, it was inferred that the application of N fertilizer increased the availability of N irrespective of the sources tried (Table 3). Among the N sources, addition of N as inorganic fertiliser (Urea) at 75 kg ha^{-1} recorded the highest available N, P and K. Addition of N as inorganic fertilizer might have enhanced the availability of Nutrients. The positive effect of N fertilisation attributed to the increased nutrient status (NPK) in the soil (Jat and Nepalia, 1995 ; Chitdeshwari *et al.*, 1997).

Thus it may be concluded that the application of 75 kg N ha^{-1} as urea was found to be optimum in increasing the herb yield but also enhanced the oil yield and nutrient availability in the soil. Combined application of organic N and inorganic N fertilizer (Urea) can be advocated for getting maximum oil recovery from the palmarosa herb.

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