

PERFORMANCE OF DIFFERENT LEVELS OF NITROGEN AND PHOSPHORUS ON HERBAGE YIELD, NUTRIENT CONTENT AND UPTAKE OF RAIN FED PALMAROSA (CYMBOPOGAN MARTINI VAR. MOTIA)- A REVIEW

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ABSTRACT

Cymbopogon martini var. Motia commonly known as **Palmarosa** or **Rosha** grass is a tall perennial tufted hedge native of most parts of sub-tropical India. **Palmarosa** oil has a sweet floral rose-like odour also has notes of rye bread, tea and clary sage. The oil is extensively used as perfumery raw material in soaps, floral rose-like perfumes, cosmetics preparations and in the manufacture of mosquito repellent products. It is used for flavoring tobacco products, foods and non-alcoholic beverages. The volatile oil is used as a remedy for lumbago, stiff joints, skin diseases and for bilious complaints. Considering the importance of this crop every efforts are being made to increase the oil production of the crop by using improved nutrient management practices.

Key words: Nutrient uptake, Palmarosa.

Cymbopogon martinii commonly known as Palmarosa or Rosha grass is a tall perennial tufted hedge native of most parts of sub tropical India. The species occurs in patches in open shrub forests in parts of Madhya Pradesh, Maharashtra and Andhra Pradesh where it is commercially collected and distilled for its oil. It is universally accepted that the use of chemical fertilizers is an integral part of the package of practices (like use of improved seeds, proper soil and water management, improved cultural practices, plant protection measures, post harvest operations etc. However literature on nutrient management in palmarosa is lacking. Therefore, the requirement of nutrients should be worked out with prime consideration to soil test values and biological yield potential for specific locations. Hence a field experiment was carried out during 2007-2008 to study the effect of Nitrogen and Phosphorus on oil yield of palmarosa. Very merge research work has been worked out on Palmarosa particularly on nutritional management therefore the literature available on other aromatic and medicinal crops is also reviewed and presented in this review under appropriate heads.

Effect of nitrogen on herbage yield of Palmarosa: Dutta and Paul (1976) stated that the 80 kg N level with P and K each of 40 kg per hectare gave higher herbage yields than unfertilized but the yield differences between various nitrogen levels were found non significant in Palmarosa grass. The yield of green grass increases significantly with increase of the doses of N from 0 to 80 kg ha⁻¹. But at N 80 kg ha⁻¹ dose, yield of grass decreases. The application of 60 kg N with P and K each 40 kg ha⁻¹ was found to increase the yield of herb and Palmarosa oil than the control. (Hazarika and Bora 1977)

Husain (1979) conducted an experiment to study economics of nitrogen fertilization in Java citronella. Nitrogen (total or fraction) was applied either as urea Straw-mud-ball of 10:1 C:N ratio or neem cake blended urea along with various combinations of spray and soil applications. Three doses of nitrogen (100, 125 and 150 kg N/ha) were used. The data obtained for the first harvest indicated that three split applications of nitrogen starting from sprouting was better than three split applications starting from planting (usual practice) at all levels of nitrogen application. There was a reduction in the herb yield when nitrogen was applied as urea Straw-

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mud-ball however herb yield increased on the application of neem cake blended urea. From series of an experiment conducted on lemon grass for more than a decade by Nair *et al.* (1979) suggested that application of 100 kg N ha⁻¹ was found to be beneficial than control.

High dose of nitrogen i.e. 120 kg N ha⁻¹ yr⁻¹ for good growth and yield of Java citronella while 80 kg N ha⁻¹ yr⁻¹ suggested for the soil with high level of fertility. The application of P and K each of 40 kg ha⁻¹ was found better results. (Virmani *et al.* 1979) A field investigation was carried out for 2 years on a red sandy loam soil in the semi-arid tropical climate of South India, to study the influence of different levels of farm yard manure (FYM) (0 and 15 t/ha per year) and fertilizer nitrogen (0, 40, 80 kg N/ha per year) on the biomass and essential oil yields of palmarosa (*Cymbopogon martinii* (Roxb.) Wats. var. *motia* Burk., family, Poaceae) grown under rainfed condition. During the period of investigation, palmarosa gave seven harvests in 2 years with 23.6–37.2 t/ha total (total of seven harvests) biomass yield, and 99.2–159.1 kg/ha total essential oil yield per hectare. Application of FYM at 15 t/ha per year increased the total biomass yield by 10.7% and total essential oil yield by 10.3% over control (no application of FYM). Addition of nitrogen (N) at 80 kg/ha per year enhanced the total biomass yield by 57.6% and total essential oil yield by 60.3% in comparison to no N application. The quality of the essential oil with 1.7% (E)- α -ocimene, 2.5% linalool, 73.1% geraniol, 15.8% geranyl acetate and 2.0% α -caryophyllene was found to be good and was readily accepted in the market. (B.R. Rajeswara Rao 2001)

Effect of phosphorus on herbage yield of Palmarosa: Chandra (1983) recorded a brief information on the requirement of phosphorus fertilizers for increasing the herb yield of following plants has been given *Plantago ovata*, *Ranwolfia canescens*, *R. Serpentina*, *Atropa* spp., *Cassia angustifolia*, *Costus speciosus*, *Trigonella foenum graecum*, *Catheranthus roseus*, *Fagopyrum* spp., *Hyoscyamus niger*, *Pepaver somniferum*, *Digitalis* spp., *Cymbopogon nardus*, *Cymbopogon martinii* var. *Motia*.

However significantly highest coriander plant height upto 51.68 cm was observed with the

application of 40 kg P₂O₅ ha⁻¹. (Ghosh and Maity 1985) . The application of P at 60 kg P₂O₅ ha⁻¹ significantly increased dry matter (28-31%) of Japanese mint over control. (Chuhan *et al.* 1991) Singh *et al.* (1991) obtained highest plant height tiller production at each cutting were increased with P levels upto 35 kg ha⁻¹ at high level nitrogen N 120 kg ha⁻¹ in all cuttings in Citronella. At same level dry matter yield was 6.97 and 10.20 t ha⁻¹ and citronella oil 211kg ha⁻¹ and 380 kg ha⁻¹ in first and second year respectively.

A field experiment was conducted by Jayashree Bhaskar (1996) at Watershed Management Research Unit, Akola who investigated that plant growth of fennel in terms of height was significantly improved with application of 40 kg P₂O₅ ha⁻¹. The application of 20 kg P₂O₅ ha⁻¹ produced significantly highest tillers plant⁻¹ (17), plant height (26 cm) and plant spread (14.5 cm) over control in Isabgol crop. Nandi and Chatterjee (1997) studied that application of 60 kg N + 50 kg P + 30 kg K ha⁻¹ gave the optimum, herbage, citronella oil and aldehyde content increased by 18.80, 10.20 and 4.00 per cent respectively over control. Sukhmal Chand and Rao (1996) carried out two field investigations on an alfic ustochrept soil under semi arid tropical climatic conditions revealed that 39 kg P and 75 kg K ha⁻¹ applied in three equal splits at one split per harvest using point placement technique produced the tallest plants. Highest tillers plant⁻¹, maximum dry herbage and essential oil yields of lemongrass without affecting essential oil content and citral percentage.

Jadhav *et al.* (2000) reported that application of phosphorus @ 20 kg ha⁻¹ to Isabgol crop produced significantly higher plant height (32.49 cm) and yield attributes viz., number of spikes plant⁻¹ (14.83), spike length (2.92 cm) over control. The application of 100 kg N/ha with 40 each P and K ha⁻¹ was gave higher return than control. It yield 20 t ha⁻¹ of fresh herbage from rainfed crop, 30 t/ha from irrigated and produced 100 kg and 180 kg lemongrass oil yield ha⁻¹ respectively (Anonymous, 2001).

Effect of nitrogen on NPK content and uptake of Palmarosa: The yield of herbage, essential oil and nitrogen uptake by the crops was increased with the increase in the rates of nitrogen from 0 to 80 kg

ha⁻¹ yr⁻¹. Maximum oil was produced at application of 80 kg N with 50 kg P and 50 kg K/ha in Citronella. (Ghosh and Chatterjee 1978) Prakasha Rao *et al.* (1983) conducted a two year experiment (1979-81) to study the effect of N, P and K fertilizers on growth and yield of Java citronella in a sandy loam soil. Application of 200 kg N ha⁻¹ yr⁻¹ resulted in significantly high yields of herb and essential oil and uptake of N, P and K. Java citronella did not respond to P and K. N recoveries by Citronella were found to be quite poor (about 20%).

Prakasha Rao *et al.* (1985) observed that application of N fertilizers 100 kg N ha⁻¹ yr⁻¹ increased the herbage and essential oil yield of *C. flexuosus* while P and K fertilizers did not show any increase. Lemongrass removed about 134 kg N, 28 kg P and 169 kg K in six harvest. N application (100 kg N ha⁻¹ yr⁻¹) increased the uptake of N, P and K by lemon grass. The apparent recoveries of N by lemon grass varied between 29 per cent and 38 per cent. Yadav *et al.* (1984) studied the fertilizer nitrogen recovery and growth of Java citronella as influenced by nitrogen and concluded that the herbage, citronella oil yields and nitrogen uptake by the crop increased with the increased rate of nitrogen from 0 to 180 kg ha⁻¹ in all cuttings. Total herbage production increased by 28.40 and 53 % and Citronella oil by 26, 38 and 49 to due 60, 120 and kg N ha⁻¹ respectively over control.

A field experiment was conducted on Java citronella for two years during 1982-84 at the Central Institute of Medicinal and Aromatic Plants, Bangalore and reported that application of 375 kg N ha⁻¹ yr⁻¹ resulted in the highest herbage yield and nitrogen uptake. The apparent N recoveries of Java citronella were very low (ranging from 11 to 17 %). Application of nitrogen at six equal splits at two monthly intervals resulted significantly higher herb yield, N uptake and apparent N recovery in comparison with other times of N application. (Prakasha Rao 1988) Sundaravadivel *et al.* (2000) observed the effects of different N sources at different rates on the oil yield and soil fertility of Palmarosa (*Cymbopogon martinii*) in Vertisols under rainfed conditions. The application of urea at 75 kg ha⁻¹ registered the highest herb yield (10606 kg ha⁻¹) and oil yield (392 kg ha⁻¹). The combined application of organic (FYM) and

inorganic (Urea) fertilizers to supply N in equal proportions at 100 kg/ha produced 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 produced highest levels of available nutrients (N, P and K) in the soil.

Effect of phosphorus on NPK content and uptake of Palmarosa: Barooh and Khader (1990) observed that addition of 40 kg P ha⁻¹ in the soil, stimulates bio-synthesis of high energy phosphate compounds and the uptake was high on 45 days after application in presence of higher N (80 and 120 kg/ha) levels resulted to higher yield in Palmarosa grass. Jamuna *et al.* (1991) reported that application of 40, 60 and 80 kg P₂O₅ ha⁻¹ increased significantly highest phosphorus content progressively at flowering with increasing grain and bhusa yield of coriander. The application of 22 kg P₂O₅ ha⁻¹ increased the K uptake (304.8 kg ha⁻¹ 2 yrs⁻¹) through biomass yield of Palmarosa. (Rajeshwara Rao *et al.* 1991) Detroja *et al.* (1996) observed that with the application of 60 kg nitrogen ha⁻¹ along with 120 kg phosphorus ha⁻¹ in fenugreek the NPK uptake of seed as well as straw increased significantly. In Isabgol crop application of 20 kg P₂O₅ ha⁻¹ recorded significantly higher N (14.60 and 17.39 kg ha⁻¹) and P₂O₅ (2.76 and 1.69 kg ha⁻¹) uptake by grain and straw, respectively over lower levels of phosphorus (Jadhav *et al.* 2000).

Aishwath *et al.* (2005) reported that application of 40 kg P₂O₅ ha⁻¹ significantly increased P uptake (8.2 kg ha⁻¹) as compared to control during first year of experimentation of Isabgol. Field experiments were conducted at Research Farm of National Research Centre For Medicinal and Aromatic Plants, Boriavi (Anand), Gujrat during 1999-2000 and 2000-2001 studied that application of 40 kg P₂O₅ ha⁻¹ recorded significantly higher uptake of N (72.7 kg ha⁻¹), P (7.8 kg ha⁻¹) and K (65.3 kg ha⁻¹) by Isabgol Crop.

Considering the importance of this crop yours are being made to increase the oil production of the crop by using improved nutrient management practices. Since, the encouraging results obtained may serves as a guidelines to the Palmarosa growers to adopt suitable technologies for higher yield.

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