Short Communication

The effect of foliar applied urea on growth, yield, and oil contents of lemon grass variety-OD-19

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Accepted 1 June, 2010

The influence of different foliar applications of urea on growth, essential oil accumulation in lemon grass (Cymbopogon flexuosus L.) was studied at the research area of medicinal and aromatic plants under department of Crop and Herbal Physiology during 2008 to 2009 to estimate the yield components, namely, plant height, tillers per plant, biomass yield, accumulation of essential oil, with treatment of different doses of urea, namely, 1, 1.25, 1.5, 1.75 and 2 g/plant compared to the untreated control. Foliar application of urea at 2 g/plant produced maximum plant height (92.7 cm), number of tillers per plant (106.05) and herb yield (357.1 g/plants) whereas maximum increase in essential oil content and leaf area was observed in treatment with 1.5 gm urea/plant as foliar application.

Key words: Urea, foliar application, essential oils, lemon grass.

INTRODUCTION

Lemon grass (Cymbopogan flexuosus) is a native aromatic tall sedge (family: belongs to Poaceae) which grows in many parts of tropical and sub-tropical South East Asia and Africa. In India, it is cultivated along Western Ghats (Maharashtra, Kerala), Karnataka and Tamil Nadu states besides foot-hills of Arunachal Pradesh and Sikkim. It was introduced in India about a century back and is now commercially cultivated in these states. Jammu lemon grass is mostly confined to North Indian states such as Jammu and Kashmir, Sikkim, Assam, Bengal and Madhya Pradesh (Handa and Kaul, 2001).

Most of the species of lemon grass are native to South Asia, South-east Asia and Australia. The so called East Indian lemon grass (C. flexuosus), also known as Malabar or Cochin grass is native to India, Sri Lanka, Burma and Thailand; for the related West Indian lemon grass (Cymbopogon citratus), a Malesian origin is generally assumed. Both species are today cultivated throughout tropical Asia. At present, India grows this crop in 3,000 ha area, largely in states of Kerala, Karnataka, U.P. and Assam and the annual production ranges between 300 and 350 t/annum.

Lemon grass flourishes in a wide variety of soil ranging from rich loam to poor laterite. In sandy loam and red soils, it requires good manuring. Calcareous and water-logged soils are unsuitable for its cultivation (Farooqi and Sreeramu, 2001). There are two markets for lemon grass oil presently, namely, Cochin and Mumbai. India is the largest producer of lemon grass and about 80% of the produce is being exported.

The oil of lemon grass has high percentage of terpenes (limonene and myrcene), beside menthyl heptenone, linalool, geranyl acetate, nerol and geraniol left in the oil after extraction of citral. Obviously, these minor fractions should be produced in high purity to fetch good price and market them separately. Further, citral can be converted into high value compounds like cintronellal, geraniol, geranyl acid and geranyl nitride, but the processes are governed by patents. An attempt should therefore be made to develop our own methods for their production or trading houses should be encouraged to buy patents to

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produce these fractions of lemon grass oil in the country.

In India, oil of lemon grass is primarily used for the isolation of citral for manufacturing Vitamin-A. Citral is the starting material for the manufacture of ionones and is also used in flowers, cosmetics and perfumes. A small amount of oil is used, in soaps, detergents and other preparations. The spent lemon grass is suitable for making paper. It is also used as fuel for the distillation of the grass. It is an excellent source of manure. It is applied either after composting or in the form of ash by burning.

It may be used for mulching coffee and a good crop for checking soil erosion. Lemon grass oil is extracted from the C. citratus, is one of the most widely used essential oil in the aromatherapy industry. Lemon grass oil is gaining its popularity owing to its lemony, sweet smell. This lemon equivalent scent of lemon grass oil has enabled it to be used in all the places where a lemon flavor is preferred. Moreover the lemon flavor has an acidic property whereas the lemon grass oil is not acidic and is also rich in Vitamin A. This has given the lemon grass oil an edge over the lemon flavor. The essential oil contains around 75 to 80% citral and exhibits medium solubility in alcohol (Joy et al., 2001).

Sugandhi (OD-19) was released from the Aromatic and Medicinal Plants Research Station (AMPRS), Odakalli, Kerala, India. It is a red stemmed variety adapted to a wide range of soil and climatic conditions and the most popular in India (Joy et al., 2006). The objective of the present investigation was to examine the effect of different doses of urea for boosting of growth, biomass and essential oil content in lemon grass variety OD-19 applied through foliar application.

MATERIALS AND METHODS

This experiment was carried out in field at the research area of Medicinal and Aromatic Plants under Department of Crop and Herbal Physiology, JNKVV, Jabalpur during 2008 to 2009 to study the effect of foliar applied urea on growth yield, oil content of lemon grass variety OD-19. The experiment was laid out in randomized block design with four replications. Uniform lemon grass slips were obtained from the farm nursery of the institute. Seedlings were planted at a distance of 1 x 1 m apart, two slips were placed into each hole, about 15 cm deep, the field was irrigated at an interval of 3 days during the first month and 7 to 10 day intervals subsequently.

Foliar sprays of urea with different concentrations, namely 1, 1.25, 1.5, 1.75 and 2 g/plant was done thrice at an interval of 30 days after planting. Care was taken to wet both sides of the leaf to a drip point. Solutions were applied in four replicates with one set left unsprayed as a control, in a complete randomized block design. Growth attributes, namely plant height, biomass yield, number of tillers, number of leaves per plant, and leaves area were measured and recorded. The height of these plants was recorded from the ground level to the base of the last full open leaves, and fresh weight of the plants was taken using electronic balance. Leaf area was recorded using portable laser area meter (Make CI-203), as per method device by Manjunatha et al. (2007). The essential oils from a known weight of freshly harvested leaves were isolated using Clevenger’s apparatus. Generally, Clevenger apparatus is used for distilling small quantities (up to 1.0 kg) of the herb in the laboratory (Clevenger, 1928).

RESULTS AND DISCUSSION

Growth and yield attributes

Foliar application was found effective over soil application. Obviously, foliar applied nutrients are directly absorbed by the plants, whereas a part of soil applied nutrients was rendered unavailable due to leaching. Application of 0.5 to 1.0% urea as foliar sprayed at 10 days before harvesting was found to increase herb and oil yield. This is in addition to the aforementioned fertilizer schedule as advocated by Kumar et al. (1996).

Foliar sprays of urea at different concentrations from 1, 1.25, 1.5, 1.75 and 2 g/plant enhanced the overall growth attributes, yield components, biomass production and significantly the highest accumulation of essential oil are as shown in Table 1.

It is evident from Table 1 that all the treatments are showing significant variation. Significantly, maximum plant height (92.7 cm) is obtained in treatment T5 (2 g urea/plant), whereas minimum plant height (69.7 cm) is observed in treatment T2 (1.25 g urea/plant). Table 1 also showed that there is significant difference in plant spread. The maximum plant spread (92.5 cm) is observed in treatment T1 (1 g urea/plant) and minimum (62.53 cm) in treatment T6, that is, control whereas treatments T2 and T6 are at par with each other. Table 1 shows that the treatments showed significant variation in respect of number of tillers per plant and herbage yield per plant. The treatment T5 produced significantly maximum number of tillers per plant (110.4) and herbage yield 357.1 g/plants having the concentration of 2 g urea/plant as foliar application, whereas least number of tillers (54.72/plant) and herbage yield (62.5 g/plant), respectively was observed in treatment T6, that is, control. It can be clearly noted that in all the treatments stem, colour is red and mid rib colour is yellow.

Data from Table 1 clearly indicates that a decreasing trend was observed for parameters like leaf area and essential oil content at concentrations higher than 1.5 g urea/plant as foliar application treatment. It revealed that significantly maximum leaf area (150.1 cm²) was observed in treatment T3 having the dose of 1.5 g urea/plant followed by treatment T5 (134.7 cm²) with 2 g urea/plant and minimum leaf area (23.57 cm²) was obtained in treatment T6, that is, control. Regarding oil content, it is clear from Table 1 that oil percentage increased significantly up to treatment T3 having concentration of 1.5 g urea/plant, but then decreased at higher concentrations of 1.75 g/plant and 2 g/plant. Therefore, treatment T3 have significantly maximum oil content (1.07%) followed by treatment T4 (1.04%), whereas minimum oil content is obtained in case of control, that is, treatment T6. Misra et al. (1991) also have similar findings in their experiment.

Finally, it can be concluded that at the highest concentration of 2 g urea/plant, growth attributes like plant height, number of tiller and herbage yield were
Table 1. Effect of different doses of urea on growth parameters, yields and oil contents of lemon grass applied through foliar application.

| Treatment | Plant height (cm) | Plant spread (cm) | No. of tillers | Leaf area (cm²) | Stem colour | Midrib colours | Herb yield (g/plant) | Oil content (%) |
|-----------|------------------|-------------------|---------------|----------------|-------------|----------------|----------------------|-----------------|
| T1 (1 g/plant) | 82.4 | 92.5 | 82.3 | 34.5 | Red | Yellow | 62.86 | 0.49 |
| T2 (1.25 g/plant) | 69.9 | 68.6 | 72.3 | 62.7 | Red | Yellow | 72.65 | 0.61 |
| T3 (1.5 g/plant) | 78.4 | 72.1 | 92.6 | 150.1 | Red | Yellow | 221.06 | 1.07 |
| T4 (1.75 g/plant) | 83.5 | 80.7 | 99.6 | 98.52 | Red | Yellow | 264 | 1.04 |
| T5 (2 g/plant) | 92.7 | 89.2 | 110.4 | 134.7 | Red | Yellow | 357.1 | 0.88 |
| Control | 71.7 | 62.53 | 54.72 | 23.57 | Red | Yellow | 62.5 | 0.38 |
| CD at 5% | 2.39 | 2.69 | 5.44 | 4.12 | - | - | 5.14 | 0.42 |
| SEM | 0.92 | 1.03 | 2.08 | 1.58 | - | - | 1.97 | 0.16 |

found maximum and significantly maximum leaf area and accumulation of essential oil was obtained in treatment T-3 having concentration of 1.5 g urea/plant; so this treatment is the best treatment.

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