



Short communication

Effect of irrigation and nitrogen on plant growth and stalk yield of lemongrass (*Cymbopogon flexuosos* S.)

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Lemon grass (*Cymbopogon flexuosus* S.) is an aromatic plant which grows in many parts of tropical and subtropical South East Asia and Africa, origin in Indo-Burma region and is native to India. Lemon grass is a tall, perennial hedge throwing up dense fascicles of leaves from a short rhizome. The crop is cultivated to obtain citral-rich essential oil used in the perfumery, cosmetic and pharmaceutical industries. Lemon grass has powerful pain relieving properties and useful for all types of pain including abdominal pain, headache, joint pains, muscle pain, digestive tract spasms, muscle cramps, stomachache and others. It can work as antifungal and anti-bacterial agent. Due to presence of vitamin A, lemon grass is helpful for skin issues such as acne pimples. Citral, found in lemon grass, can harm cancer cells (<http://heathers.org/lemongrass/>). Traditionally lemongrass is grown in high rainfall area as a rainfed crop. But under semi-arid tropical conditions, lemongrass thrives well under irrigated conditions. A temperature ranging from 20–30 °C and good sunshine throughout the year is conducive to high crop yield with better oil content. Research showed that herb yield can be increased with nitrogen application (PrakasaRao *et al.* 1991). Hence the present studies were conducted to study the agronomical investigation on lemongrass under semi-arid tropical conditions.

MATERIALS AND METHODS

The field experiment was carried out at the ACE farm of Fieldfresh Foods Pvt. Ltd, Ladhawal, Ludhiana during summer season 2013. The soil of the plot was a rich alluvial loam soil with medium fertility slightly high pH of 7.8. The soil contains 0.32% organic carbon 198 kg.ha⁻¹ available N, 13.2 kg.ha⁻¹ available P₂O and 181.4 kg.ha⁻¹ exchangeable K₂O. The water holding capacity of the soil was 12.1 % at 0.3 mpa. The climate of the experimental site is characterized as sub-tropical condition. The mean minimum and maximum temperature ranges between 5–20 °C and 18–42 °C, respectively. The relative humidity is high which ranges between 65% and 90%. Rooted stalks of lemongrass were transplanted in the experimental plot and full doses of P₂O₅ and K₂O at 40 kg.ha⁻¹ were applied as single superphosphate and muriate of potash at the time of planting. Nitrogen was applied in six equal stalk doses at 60 days interval in the form of urea by placing at 5 cm below the soil in between the rows of lemongrass. Weekly irrigation was given depending upon the climatic conditions and weeds removed by hand whenever necessary. The experimental treatments consisted of three level of irrigation (0.25, 0.50 and 0.75 IW: CPE ratio) with four rates of N application (0, 50, 100 and 150 kg.ha⁻¹) with three replications. Irrigation levels were arranged in main plots and nitrogen application rates in sub plots. Before imposing irrigation treatment, four common irrigations were given (at 25 mm water per irrigation) for the proper establishment of the crop. During experiment, plant growth and herbage yield were recorded in the month of May, June and July. Following observations was taken under the present study: i. plant height, ii. No. of branches, iii. No. of stalks/plant, iv. Width of stalks, v. Weight of stalks and vi. Stalk yield.

RESULT AND DISCUSSION

The results of the present study as well as relevant discussion have been summarized under following heads:

Effect of Irrigation

The effect of irrigation level on lemongrass, the level 0.75 was found significantly influenced the plant height, maximum 114.3 cm followed by 0.50 WI level (108.5cm) and also maximum number of branches 45.8

and 44.3 at respective irrigation level were recorded in the lemongrass. The number of stalk (42.9), stalk width (5.4 mm), weight of stalk (22.5 gm) and stalk yield (4.6 q.ha^{-1}) also the irrigation level was found most effective. Followed by 0.50 and 0.25 IW level who provided number of stalk (41.8 and 337), stalk width (5.2 and 4.7 mm), weight of stalk (21.7 and 18.8 gm) and stalk yield (4.5 and 4.0 q.ha^{-1}) at respective level of irrigation.

Table 1. Effect of irrigation level and nitrogen on morphology and yield of lemongrass.

Main plot	Plant height (cm)	Number of Branches	Number of stalks	Stalks width (in mm)	Stalks Weight (gm)	Stalk yield per acre
0.25 IW	89.9	39.5	33.7	4.7	18.8	4.0
0.50 IW	108.5	44.3	41.8	5.2	21.7	4.5
0.75 IW	114.3	45.8	42.9	5.4	22.5	4.6
CD at 5%	3.38	2.64	2.96	0.81	0.94	0.65
SE \pm	1.18	0.93	1.04	0.28	0.33	0.23
Sub plot						
N 0 Kg	81.2	36.8	36.2	4.2	16.9	3.8
N 50 Kg	100.1	42.9	41.0	5.0	20.9	4.3
N 100 Kg	113.2	47.7	43.3	5.7	23.4	4.7
N150 Kg	122.4	45.4	42.6	5.4	22.7	4.5
CD at 5%	2.78	1.66	2.77	0.80	1.22	0.60
SE \pm	1.31	0.78	1.31	0.38	0.58	0.29

Effect of Nitrogen

Effect of Nitrogen level on morphological characters of lemongrass, the nitrogen levels 150 kg.ha^{-1} was significantly influenced the lemon grass yield with the consistent and maximum plant height (1.22 cm) recorded, followed by N 100 kg (113.2 cm) and N 50 kg (100.1 cm) recorded, whereas in case of number of branches and stalk, the N 100 kg was found best among all level with maximum number of braches (47.7), number of stalk (43.3), stalk width (5.7 mm) and stalk weight (23.4 gm). The effect of nitrogen @ 100 kg was found most effective with maximum yield 4.7 q.ha^{-1} and it was showed statically parity with 150 kg nitrogen (4.5). In order to the next effective treatment was 50 nitrogen application with a yield 4.3 q.ha^{-1} recorded of lemongrass.

Interaction Effect

The results of the present investigation on the effect of irrigation and nitrogen application on foliage growth and yield parameters, irrigation 0.75 IW + 150 kg N application was found statically superior over the rest treatments with maximum plant height 1.37.3 cm and in order to next effective treatment was irrigation 0.50 IW + 150 kg N with plant height 132.0 cm, whereas in case of number of branches and stalk, the 0.75 IW + 100 kg N application showed most efficient with maximum number of braches (52.3), number of stalk (46.7), stalk width (6.1 mm) and stalk weight (25.0 gm) and it was statically at par with 0.50 IW + 100 kg N application who provided 50.0, 45.0, 5.9 cm and 24.3 gm, respectively. The interaction effect of 0.75 IW + 100 kg N application was found most remunerative with maximum 5.0 q ha^{-1} of lemongrass yield and it was satirically at par with 0.50 IW + 100 kg N application with lemongrass yield 4.9 q.ha^{-1} . These results agree with that of Singh *et al.* (1996). The application of 100 kgN.ha^{-1} produced significantly higher fresh stalk yield & plant growth (height 130 cm), number of branches (56.4), number of stalks/plant (50.40), width of stalks (5.64), weight of stalks (24.2) compared with that from 0 kgN.ha^{-1} (control) as reported by Rajan *et al.* (1984) and PrakasaRao *et al.* (1985).

Table 2. Effect of irrigation and nitrogen interaction on foliage growth and yield parameters.

Interaction	Plant height(cm)	Number of Branches	Number of stalks	Width of stalks (in mm)	Weight of stalks (gm)	Stalk yield per acre
0.75 IW x N 100 Kg	125.7	52.3	46.7	6.1	25.0	5.0
0.75 IW x N 150 Kg	137.3	47.7	44.7	5.7	24.0	4.7
0.50 IW x N 150 Kg	132.0	46.3	43.3	5.5	23.3	4.6
0.50 IW x N 100 Kg	119.0	50.0	45.0	5.9	24.3	4.9
0.75 IW x N 50 Kg	110.0	45.0	43.7	5.2	22.7	4.5
0.50 IW x N 50 Kg	102.3	44.3	42.3	5.1	21.0	4.4
CD at 5%	5.25	3.25	N/A	1.50	2.20	1.12
SE \pm	2.27	1.36	2.27	0.66	1.00	0.49

Interaction effects of irrigation and N rates were significant for the plant growth and stalk yield. The response of lemongrass to increasing N application rates was greater at the highest than at the lower water regime. Water use www.tropicalplantresearch.com

efficiency (WUE) by lemongrass was lowest in wet regimes and highest in dry regimes. The decrease in WUE at higher soil moisture regimes is due to a dilution effect, which is in agreement with the findings of Yadav & Prasad (1988) in sugar cane.

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