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POTENTIAL OF LEUCAENA HEDGES FOR FOOD CROP PRODUCTION IN SOUTHERN EGYPT

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ABSTRACT

Maize (*Zea mays* L.) var.Giza 151 was intercropped for 2008 and 2009 seasons between hedgerows of leucaena (*Leucaena leucocephala* L.) spaced 3 or 5 m apart, while maize was planted in hills 40 cm apart in rows spaced 75 cm, in loamy sand soil at Kom-Ombo Tropical Farm, Aswan Botanical Garden, Hort. Res. Inst., Agric. Res. Center, Egypt. The leucaena was cut at a height of 30 or 60 cm, 2 or 3 times per season and the fresh prunings spread as a mulch between the rows of maize. The yield of maize from mulched plots was measured and compared with that from plots fertilized with nitrogen as urea at 0, 30 or 60 kg N/fed.year. In the two seasons, leucaena dry yield was significantly affected by leucaena mulch treatments with the highest values 1131.28 g/ m row and 6787 g/ plot were due to 30 cm height and two cuts per season for hedgerow spacing of 3 m, while the lowest values 723.9 g/ m row and 4343.6 g/ plot were recorded with the 60 cm height, 3 cuts, 5 m treatment. However, the effect of leucaena pruning treatments was differed for N and protein contents in leucaena leaves, while the concentrations of N and protein were increased by using 30 cm height and 3 cuts per season of 5 m spaced leucaena. On the other hand, 60 cm height with two cuttings/ season in 5 m spaced leucaena increased cellulose content in leucaena prunings compared to the other treatments. Higher maize yields were obtained with supplementation with 60 kg N/ fed. Addition of leucaena prunings was able to sustain maize yields at moderate levels, for two consecutive years with no N addition. Addition of leucaena prunings improved soil fertility as increment of organic matter percentage and decreased the values of pH and E.C in the soil. (the results which are mentioned at the means of to seasons)

Keywords: Alley cropping, *Leucaena leucocephala*, *Zea mays*, Pruning management, Nitrogen fertilizer.

INTRODUCTION

Agroforestry may be the most important solution towards sustainable development in Africa, as it can be used to address three important problems associated with the Third World development, viz. low production, soil erosion and sufficient quantities of fuel wood. In arid and semi-arid areas, agroforestry could help provide insurance against climatic extremes. Shrubs and trees could provide food, fodder and fuel wood, windbreaks and live fences; and reduce surface runoff, evaporation and soil erosion (Swaminathan, 1987). Incorporation of legume into the soil may increase decomposition on N release rates, resulting in greater N availability to the associated crop. Isaac *et al.* (2003) observed higher organic N in soils which leucaena prunings had been mulched on the surface than in soils in which prunings were incorporated into the soil.

Alley cropping supplies various plant nutrients, but most research has been related to its potential to provide N to the associated crop

(Balasubraminian and Sekayange, 1991; Dalland *et al.,* 1993; Mafonogoya and Nair, 1997 and Okogum *et al*., 2000). Estimates of leucaena N recovery by a maize crop have been reported to range from 3 to 59% under varying climatic conditions (Mofonogoya and Nair, 1997 and Mugendi *et al.,* 2000). Management practices that maximize biomass availability to the companion crop during the period when it may benefit from nutrient release and minimize N losses need to be evaluated (Isaac *et al.,* 2004). On the other hand, Myers *et al.* (1994) attributed N use efficiency in most agroforestry systems to lack of synchronization between N release and companion development. They also reported that environmental conditions (soil type, nutrient status, climate and management practices may alter chemical composition (as cellulose) of legume species, affecting N mobilization and release from residues.

Leucaena (*Leucaena leucocephala* L.) belongs to the family Mimosaceae; it is capable of producing a large volume of a medium- light hardwood for fuel with low moisture and a high value, and makes excellent charcoal, producing little ash and smoke. It also can be used for parquet flooring and small furniture as well as for paper pulp (Brewbaker *et al*., 1985). It has shown good potential as a high-protein fodder with good digestibility that could substitute for conventional concentrated feeds for cattle. The leaves and young stems provide good leaf forage for a range of domestic and wild ruminants (Ramirez and Garcia, 1996). Leucaena is also often intercropped with a range of food or fodder crops; a system referred to as alley cropping or (hedgerow) intercropping. Different cutting methods are used for the harvesting of leucaena and different cutting heights have been used, the most common being regular pruning to a hedgerow. The pruning yield is often used as a green manure, mulch (layering the green material of the soil surface) or animal feed. These practices are reported to have a beneficial effect on the quality and yield of the alley crop as well as an ameliorating effect on the soil (Brewbaker, 1987).

Important considerations in assessing hedgerow species for alley cropping are the amount and rate of N released that can benefit the companion crop. Although research has shown that prunings of legume species for alley cropping can be an effective source of N for crop production (Kang and Wilson, 1987). However, contents of N, lignin and cellulose are chemical factors controlling degradability of plant materials added to soil (Constantinides and Fowens, 1994).

Decline in soil productivity and environmental quality and absent of natural resources in many countries like Egypt have led to a search for new methods to sustain crop production via more efficient nutrient cycling. Also, the challenge resides in sustaining crop production while maintaining of organic residues. Alley cropping is the growing of crops, usually food crops, in an alley formed by trees or woody shrubs that are cut back at crop planting and maintained as hedgerows by frequent trimming during cropping (Wilson *et al.*, 1986). It results in improvements in soil chemical properties and nutrient cycling, erosion control and weed suppression, in addition to providing fodder, stakes and firewood (Kang and Alley, 1989). However, crop yield respond in alley cropping is largely dependent on the amount and quality of hedgerow prunings applied, timing of application, and field management of prunings that regulate nutrient supply (Mafonogoya and Nair, 1997).

Nitrogen fertilizer use has played a significant role in increase of crop yield. The application amounts of nitrogen fertilizer have dramatically increased in recent years, resulting in excessive use of N fertilizer, thus severe environmental and ecological problems, for example, nitrate pollution in ground water and greenhouse gas emissions that contribute to global warming. Therefore, this study was designed to examine the effects of various leucaena (as legume tree that provide nitrogen fixation) management practices on: 1) the dry yield production and chemical characteristics of leucaena prunings; 2) the productivity of maize as an important food crop and compared with that from nitrogen fertilization and 3) the changes in soil quality due to leaf drop or the application of leucaena prunings as mulch.

MATERIALS AND METHODS

An alley-cropping system was established during 2008 and 2009 seasons at Kom-Ombo Tropical Farm, Aswan Botanical Garden, Hort. Res. Inst., Agric. Res. Center, Egypt on a loamy sandy soil which is similar in texture and fertility to many of newly reclaimed soils in Egypt. The initial levels of soil pH, E.C. and organic matter were 8.4, 0.37 ds/ m and 0.40%, respectively.

A field experiment was adopted to study the effects of N fertilization either as inorganic or as organic (leucaena mulch treatments) on growth and yield of maize. Scarified leucaena seed (by soaking seeds in boiled water 95 C° till room temperature extended to 24 hours) was sown in rows at 3 or 5 m apart in October 2007 by using 5 gm seed /m and allowed to grow without cutting for 11 months and when the first season of maize crop was sown most leucaena plants were 2.0 m high.

Maize seeds (*Zea mays* L.) var. Giza 151 was sown in hills 40 cm apart in rows spaced 75 cm .Three seeds were planted per hill and thinned to one plant 15 day after planting. Maize seeds were sown on August 1, 2008 and 2009. The field was immediately irrigated after planting and all other agronomic operations except those under study were kept normal.

Leucaena cutting treatments (planting space 3 and 5 m apart, cutting height 30 and 60 cm and cutting frequencies 2 and 3 cuts/ season) was commenced in August of each year and continued until December of the same years. At each cut, leucaena material was subsampled for determination of dry weight (g/ m for row) and chemical analysis as nitrogen and cellulose contents in leaves. Then, leucaena material was spread evenly over the plot between the rows of maize. Urea was broadcast on the soil surface of plots containing only maize plots at the time of the first leucaena cut. The potassium mineral fertilizer was applied to maize plants in the experiment at the rate of 100 kg potassium sulphate (48 % K_2O/ fed). No other fertilizer was used in the experiment. The size of the plot was 3x5 m or 3x3 m according to treatment. Plots of similar size containing maize plants (sole maize) were also established and received nitrogen fertilization as urea at 0, 30 and 60 kg N/fed. year. There was a 1.5 m border area between plots and there were three replications. Therefore, a complete randomized design was used in the present experiment. Plots were arranged into the field and distributed into three replicates; each contains 3 plots. The following treatments of N as urea (as chemical fertilizer) for plots containing sole maize or the treatments of leucaena cutting height and frequency as well as leucaena spacing (as organic fertilizer) for plots containing maize in between leucaena rows were:

(1) 0 kg N/fed
(2) 30 kg N/fed
(3) 60 kg N/ fed
(4) 30 cm cutting height, 2 cutting frequency, 3 m leucaena spacing
(5) 30 cm cutting height, 3 cutting frequency, 3 m leucaena spacing
(6) 60 cm cutting height, 2 cutting frequency, 3 m leucaena spacing
(7) 60 cm cutting height, 3 cutting frequency, 3 m leucaena spacing
(8) 30 cm cutting height, 2 cutting frequency, 5 m leucaena spacing
(9) 30 cm cutting height, 3 cutting frequency, 5 m leucaena spacing
(10) 60 cm cutting height, 2 cutting frequency, 5 m leucaena spacing
(11) 60 cm cutting height, 3 cutting frequency, 5 m leucaena spacing

Harvest samples of maize were taken of 3 m long from the three middle rows for determination grain yield. Mature plant heights of 10 random plants per plot were determined as the distance from ground surface to the lowest branch of the panicle. Number of kernels in 10 ears was counted and divided by the number of ears. The grain of the same 10 ears was weighted and divided by the number of ears.

Nitrogen and protein contents (%) of oven- dry leaves of leucaena samples were determined after Kjeldahl digestation. Cellulose (in prunings dry matter) was determined by treatment of extractive free sawdust meal with nitric acid and sodium hydroxide: one gram of extractive free was treated with 20 ml of a solution of nitric acid 3% in flask and was boiled for 30 min. The solution was filtered in crucible G3. The residue was treated with 25 ml of a solution of sodium hydroxide 3% and was boiled for 30 min. The residue was filtered, washed with warm water to neutral filtrate, dried and weighted (Nikitin, 1960). Cellulose content= weight of cellulose/ oven dry weight x 100.

Soil samples from 0- 15 cm depth was taken from each plot before planting maize in 2008 and after the two cropping seasons of maize. These samples were bulked, subsampled and analysed for total nitrogen (Bremmer and Mulvaney, 1982) and organic matter (Jackson, 1973).

All means were compared using LSD at 5% level according to Gomez and Gomez (1984).

RESULTS

Leucaena yield:

Dry yield of leucaena (g/ m of row and g/ plot):

Presented data in table 1 showed that dry yield for 1 m row and plot of leucaena was significantly increased due to 30 cm cutting height, 2 cuts/

season, especially with 3 m hedgerow spacing, in both seasons, compared to other leucaena practice treatments. However, 30 cm cutting heights gave a significant greater yield than 60 cm cutting height in the two seasons. The lowest amounts of leucaena mulch applied per unit area were detected in the 60 cm cutting height, 3 cuts/ season, 5 m spacing, followed by 60 cm cutting height, 3 cuts/ season with 3 m distance between hedge rows compared to other treatments in the two studied seasons.

Table (1) : Dry yield (g/ m row and g/ plot) of leucaena during 2008 & 2009 seasons as affected by leucaena cutting height (cm) and frequencies as well as row spacing (m) treatments in an alley cropping system.

Treatments	Dry yield (g/ m row)		Dry yield (g/ plot)*	
	2008	2009	2008	2009
0 kg N/ fed	-------	-------	-------	-------
30 kg N/ fed	-------	-------	-------	-------
60 kg N/ fed	-------	-------	-------	-------
30cm/ 2cut/ 3m	1122.23	1140.33	6733.38	6841.98
30cm/ 3cut/ 3m	1005.63	975.47	6033.78	5852.82
60cm/ 2cut/ 3m	832.67	938.73	4996.02	5632.38
60cm/ 3cut/ 3m	736.87	767.33	4421.22	4603.98
30cm/ 2cut/ 5m	1047.27	1060.27	6283.62	6361.62
30cm/ 3cut/ 5m	920.57	920.51	5523.42	5523.06
60cm/ 2cut/ 5m	779.10	826.30	4674.60	4957.80
60cm/ 3cut/ 5m	711.47	736.4	4268.82	4418.40
LSD 5% **	**47.87**	**31.06**	**287.23**	**186.38**

*** = Each plot had 2 rows from leucaena plants at the tow sides of the plot.**
**** = notes LSD at 5% levels values were calculated on 8 treatments average only.**
0, 30 and 60 kg N/ fed = Nitrogen fertilization treatments as urea.
30 and 60 cm = Cutting height of leucaena.
2 and 3 cuts = Cutting frequency of leucaena.
3 and 5 m = Leucaena row spacing.

Nitrogen and protein contents (%) in leucaena leaves:

Data in table 2 represents the effects of spacing and pruning treatments in an alley cropping with maize on nitrogen and protein percentages in leucaena leaves during 2008 and 2009 seasons. It is clearly appeared that these characters were increased in leucaena leaves as a result of using 30 cm cutting height, 3 cuts/ season with 5 m row spacing treatment, followed by the same practices but with 60 cm cutting height treatment, while the lowest values 2.6 and 16.2 % for nitrogen and protein contents, respectively were recorded with 60 cm height, 2 cuts, 3 m spacing treatment the results as the mean of two seasons. Generally, 2 cuts per season of leucaena plants decreased nitrogen and protein percentages in their leaves, while 3 cuts/ season improved it as mean of seasons.

Table (2) : Nitrogen and protein contents (%) of leucaena dry leaves during 2008 & 2009 seasons as affected by leucaena cutting height (cm) and frequencies as well as row spacing (m) treatments in an alley cropping system .

Treatments	Nitrogen percentage		Protein percentage	
	2008	**2009**	**2008**	**2009**
0 kg N/ fed	-----	------	------	------
30 kg N/ fed	-----	------	------	------
60 kg N/ fed	------	------	------	------
30cm/ 2cut/ 3m	2.89	2.78	17.92	17.24
30cm/ 3cut/ 3m	3.04	2.95	18.85	18.29
60cm/ 2cut/ 3m	2.79	2.44	17.30	15.13
60cm/ 3cut/ 3m	2.90	3.07	17.98	19.03
30cm/ 2cut/ 5m	3.13	2.73	19.41	16.93
30cm/ 3cut/ 5m	3.23	2.97	20.03	18.41
60cm 2cut/ 5m	3.28	2.48	20.34	15.38
60cm/ 3cut/ 5m	3.09	3.01	19.16	18.66
LSD 5%	**0.15**	**0.19**	**0.97**	**1.15**

0,30 and 60 kg N/ fed = Nitrogen fertilization treatments as urea.
30 and 60 cm = Cutting height of leucaena.
2 and 3 cuts = Cutting frequency of leucaena.
3 and 5 m = Leucaena row spacing.

Cellulose content (g/ kg) of leucaena :

Cellulose content (g/ kg) of leucaena plants as affected by spacing and pruning height and frequency are presented in table 3.

Table (3) : Cellulose content (g/ kg) of leucaena prunings during 2008 & 2009 seasons as affected by leucaena cutting height (cm) and frequencies as well as row spacing (m) treatments in an alley cropping system.

Treatments	Cellulose content (g/ kg)	
	2008	**2009**
0 kg N/ fed	-----	-----
30 kg N/ fed	-----	-----
60 kg N/ fed	-----	-----
30cm/ 2cut/ 3m	145.03	142.37
30cm/ 3cut/ 3m	144.27	146.70
60cm/ 2cut/ 3m	142.47	138.70
60cm/ 3cut/ 3m	146.63	141.83
30cm/ 2cut/ 5m	145.67	142.43
30cm/ 3cut/ 5m	144.10	146.57
60cm 2cut/ 5m	156.73	147.40
60cm/ 3cut/ 5m	150.20	142.53
LSD 5%	**9.04**	**5.95**

0,30 and 60 kg N/ fed = Nitrogen fertilization treatments as urea.
30 and 60 cm = Cutting height of leucaena.
2 and 3 cuts = Cutting frequency of leucaena.
3 and 5 m = Leucaena row spacing.

It is worthy to notice that cellulose concentration in leucaena hedges was increased due to sowing of leucaena rows at 5 m spacing in comparison to sowing at 3 m spacing, but the increment was not significant in the two seasons. The highest yield of cellulose (152.1 g/ kg) as the mean of two sesons was obtained when leucaena hedges at 5 m spacing were pruned two times at 60 cm height from ground level in the mean of seasons, while the lowest one (140.6 g/ kg), as the mean of two seasons, was detected when leucaena rows at 3 m spacing were pruned two times at 60 cm height.

Maize yield:

Plant height (cm):

Plant height of maize (cm) as affected by applied fertilizer nitrogen and leucaena mulch treatments is presented in table 4. In the two seasons, maize plant height was significantly increased due to the applied treatments compared to the control.

Table (4): Plant height (cm) and number of kernels/ear of maize as fertilized with urea or leucaena mulch in an alley cropping during 2008&2009 seasons.

Treatments	Plant height		Number of kernels/ ear	
	2008	2009	2008	2009
0 kg N/ fed	171.5	175.1	297.6	304.1
30 kg N/ fed	184.4	189.5	439.3	431.2
60 kg N/ fed	197.7	201.4	565.6	540.3
30cm/ 2cut/ 3m	181.8	179.3	353.6	464.6
30cm/ 3cut/ 3m	183.5	181.4	476.8	428.8
60cm/ 2cut/ 3m	185.4	180.5	463.7	419.5
60cm/ 3cut/ 3m	184.7	188.5	499.4	512.4
30cm/ 2cut/ 5m	180.3	181.4	378.7	437.6
30cm/ 3cut/ 5m	182.5	187.5	497.1	456.4
60cm 2cut/ 5m	190.4	189.4	468.3	450.4
60cm/ 3cut/ 5m	190.3	191.6	514.3	525.2
LSD 5%	**8.06**	**5.61**	**18.44**	**6.21**

0,30 and 60 kg N/ fed = Nitrogen fertilization treatments as urea.
30 and 60 cm = Cutting height of leucaena.
2 and 3 cuts = Cutting frequency of leucaena.
3 and 5 m = Leucaena row spacing.

The control treatment (0 kg N/ fed) gave the lowest plant height of maize in the two studied seasons, while increasing rates of applied fertilizer nitrogen resulted in gradually increased. Data showed that the most favorable treatments for plant height were 60 kg N/fed followed by 60 cm cutting height, 3 cuts, 5 m row spacing treatment, while the lowest values were recorded with the control plants (0 kg N/ fed) followed by 30 cm cutting height, 2 cuts, 3 m row spacing treatment in the two seasons. Generally, all leucaena mulch treatments produced maize plants approximately similar in their heights to the 30 kg N/ fed treatment and all were significantly greater than control. In both seasons in the leucaena mulched plots, mean height of maize plant in the 5 m row spacing was higher than those in 3 m spacing, while the leucaena cutting height and cutting frequency had slightly affect on maize height and the highest values were obtained by 60 cm cutting height as the mean of two seasons.

Number of kernels per ear:

Data regarding the effect of applied fertilizer nitrogen and leucaena mulch treatments on number of kernels per ear are given in table 4. The response of number of kernels per ear to the used treatments was significant in the two studied seasons. The maximum number of kernels per ear (552.9) was recorded at 60 kg N/ fed followed by 60 cm cutting height, 3 cuts, 5 m row spacing treatment (519.7), while the minimum (300.8) with 0 kg N/ fed followed by 30 cm cutting height, 2 cuts, 5 m row spacing treatment (408.1) in the mean of seasons. In both seasons in the leucaena mulched plots, mean number of kernels per ear in the 5 m row spacing was slightly higher than those in 3 m spacing. Also, leucaena cutting height and cutting frequency had slightly affect on this character and the highest values were obtained by 60 cm cutting height with 3 cuts/ season in the two seasons. . (the results which are mentioned at the means of to seasons)

Weight of grains per ear (g):

Data recorded on average weight of grains per ear of maize is presented in table (5). Applied fertilizer nitrogen influenced significantly the weight of grains per ear and this character generally increased with increase in nitrogen levels.

Table (5): Weight of grains/ear (g) and grain yield (t/fed.) of maize fertilized with urea or leucaena mulch in an alley cropping during 2008&2009 seasons.

Treatments	Weight of grains/ear (gm)		Grain yield (t/fed.)	
	2008	2009	2008	2009
0 kg N/ fed	77.23	72.93	1.90	1.79
30 kg N/ fed	86.43	85.00	2.39	2.15
60 kg N/ fed	103.93	99.70	3.17	3.09
30cm/ 2cut/ 3m	83.67	82.60	2.26	2.23
30cm/ 3cut/ 3m	84.03	84.67	2.28	2.17
60cm/ 2cut/ 3m	85.47	85.60	2.27	2.39
60cm/ 3cut/ 3m	87.47	87.70	2.32	2.81
30cm/ 2cut/ 5m	87.40	88.07	2.35	2.34
30cm/ 3cut/ 5m	83.13	88.63	2.29	2.35
60cm/ 2cut/ 5m	86.57	89.47	2.46	2.48
60cm/ 3cut/ 5m	90.53	89.53	2.43	2.86
LSD 5%	**8.84**	**6.21**	**0.06**	**0.11**

0, 30 and 60 kg N/ fed = Nitrogen fertilization treatments as urea.
30 and 60 cm = Cutting height of leucaena.
2 and 3 cuts = Cutting frequency of leucaena.
3 and 5 m = Leucaena row spacing.

The heaviest grains (101.8 g/ ear) was detected with the third nitrogen fertilizer level followed by 60 cm cutting height, 3 cuts/ season, 5 m row spacing treatment (90.03 g/ ear), while the lightest one (75.08 g/ ear) was at 0 kg N/ fed followed by 30 cm cutting height, 2 cuts/ season, 3 m row spacing treatment (83.1 g/ ear) in the mean of seasons. In the two studied seasons in the leucaena mulched plots, mean weight of grains per ear in the 5 m row spacing was higher than those in 3 m spacing and the differences were not significant. On the other hand, leucaena cutting height and cutting frequency had slightly affect on this character and the highest values were obtained by 60 cm cutting height with 3 cuts in the mean of seasons. . (the results which are mentioned at the means of to seasons)

Grain yield (t/fed):

The effect of nitrogen fertilizer and leucaena mulch treatments on grain yield of maize in an alley cropping was shown in table 5. It is obvious from the table that there is a significantly difference only between means of the nitrogen fertilization treatments for both seasons. The most pronounced effect of the applied treatments on this character was due to using 60 kg N/ fed followed by 60 cm cutting height, 3 cuts/ season, 5 m row spacing treatment in the mean of both seasons. Meanwhile, the control (0 kg N/ fed) treatment followed by 30 cm cutting height, 3 cuts/ season, 3 m row spacing treatment resulted in the lowest grain yield in the mean of seasons. In the two studied seasons in the leucaena mulched plots, mean of grain yield in the 5 m row spacing was higher than those in 3 m spacing and the leucaena cutting height and frequency had slightly affect on this character. In this respect, the highest values of grain yield were obtained in the mean of seasons by 60 cm cutting height with 3 cuts/ season.

Table (6): Effect of fertilizer nitrogen and leucaena mulch treatments on soil contents of organic matter (%), pH and E.C after the two seasons (2008 & 2009) of maize cropping.

Treatments/ Soil properties	0 kg N/ fed	30 kg N/ fed	60 kg N/ fed	Leucaena mulch
OM%	0.90	1.38	1.16	2.16
pH values	8.39	8.11	8.19	7.73
E.C ds/m	0.38	0.33	0.35	0.29

Soil measurements:

Mean of organic matter, pH and E.C before maize cropping were about 0.40%, 8.40 and 0.37 ds/ m, respectively. After the two seasons of cropping, mean of organic matter percentage increased with the highest value (2.16%) was obtained due to leucaena mulch treatments (Table 6). Meanwhile, the values of pH and E.C were decreased by using the different treatments especially with leucaena mulch treatment.

DISCUSSION

The beneficial effect of applying leucaena prunings to maize and soil was evident during the growing. In our alley-cropped treatments, effect of competition was probably less, due to application of prunings, which provided N to the associated maize crop. However, mode of pruning application has been reported to influence effects of tree roots on crops by affecting the efficiency of nutrient utilization by the crops and eventually growth and distribution of roots in soil as reported by Kang and Mulongoy (1992).

Obtained results of this experiment show that maize can be grown successfully in an alley cropping system with leucaena and that maize yields can be maintained at moderate levels without large inputs of inorganic fertilizers. Similar results have been reported by Kang and Mulongoy (1992); Okogun *et al.* (2000) and Isaac *et al.* (2003). In the two studied seasons, the growth and yield parameters of maize that applied by leucaena mulch treatments were similar or increased to that obtained from 30 kg N/ fed as urea, thus confirming the lower recovery of N from leucaena prunings than from inorganic N fertilizer as reported by Kang *et al.* (1981). On the other hand, concentrations of nitrogen, protein and cellulose in leucaena prunings were comparable with values previously found by Lehmann *et al*. (1995) and Jama and Nair (1996). It is hypothesized that management practices and environmental conditions may affect chemical composition rates of leucaena prunings.

The trend towards a lower yield when maize plants were grown between the 3 m spaced leucaena rows indicate that 5 m row spacing is probably about the optimum spacing for leucaena in our cropping system. Meanwhile, leucaena grown in 3 m spaced would provide more mulch (Table 1) but the area available to maize plants would be reduced, competition between the two species would increase and maize yield per unit area probably would be depressed.

Cutting at 30 cm height with 2 cuts per season gave a consistently higher dry yield of leucaena, while 60 cm height with 3 cuts per season resulted in increased parameter growth and yield of maize, these results are similar to those of Ferraris (1979). In practice, less frequent cutting reduce the demand for labour and the larger individual applications of mulch may have beneficial effects on weed control (Kang *et al*., 1981) and soil moisture status (Ssekabembe, 1985).

CONCLUSIONS

Both residues of leucaena prunings and adding nitrogen fertilizer played an important role in contributing nutrition to the alleyed crop (maize) in this cropping system. Maize products and soil fertility are produced in addition to leucaena prunings, with no reduction in crop yields per unit area. In the newly reclaimed soils as well as limited resources in countries like Egypt, alley cropping can play a significant contribution of the multiple component yield and economic condition of the farmers. From our results, maize in between leucaena was gave moderate yield per unit area without addition of inorganic nitrogen fertilizer. Based on N recommendation for maize (60 kg N/ fed) in the region where the study was conducted, the N released from leucaena prunings in this region would be adequate for maize production with few addition of inorganic N fertilizer. So, field crops as maize under this alley cropping might be encouraged to save the mineral fertilizer, decrease an excessive use of N fertilizer as well as improve the environmental and ecological conditions. Also, in light of shortage the summer green fodder in

Egypt, now and then the leucaena prunings are an alternatively favourable fodder.

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أسيجة الليوسينا وإمكانية إنتاج محاصيل الغذاء بجنوب مصر

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أجريت هذه الدراسة بالمزرعة الاستوائية بكوم أمبو- الحديقة النباتية بأسوان- معهد بحوث البساتين- مركز البحوث الزراعية خلال عامى ٢٠٠٨ ، ٢٠٠٩ بهدف دراسة امكانية انتاج المحاصيل الغذائية متمثلة فى الذرة الشامية فى نظم الزراعة المختلطة بالغابات متمثلة فى نظام الزراعة الشرائحية (Alley cropping) والتى يتم فيها زراعة الأشجار خاصة البقولية منها والتى يكون لها القدرة على تثبيت الأزوت الجوى، مع تقليمها باستمرار لتقليل التنافس (على الضوء، الماء، والغذاء) مع المحاصيل الزراعية المجاورة. وقد تم زراعة الذرة الشامية (صنف جيزة ١٥١) فى نظام الزراعة المختلطة مع أشجار الليوسينا ، حيث كانت نباتات الليوسينا منزرعة قبل اجراء التجربة بعام فى خطوط على مسافة ٣ ، و ٥ م وزرعت نباتات الذرة الشامى بين صفوف الليوسينا فى جور وعلى مسافة ٤٠ سم على خطوط بينها مسافة ٧٥ سم فى تربة رملية طميية . واشتملت التجربة على دراسة معاملات مختلفة تجرى على أشجار الليوسينا لدراسة تأثيرها على نباتات الذرة الشامى المنزرعة بين صفوف الأشجار، ومقارنة ذلك بتأثير التسميد الكيميائى على نباتات الذرة الشامى. و قد تضمنت الدراسة المعاملات التالية: ثلاث مستويات تمثل التسميد النيتروجينى (يوريا) لنباتات الذرة بدون أشجار وهى صفر ،و ٣٠ ،و ٦٠ كجم نيتروجين/ فدان (كتسميد كيميائى) بالاضافة الى ثمانية معاملات أجريت على أشجار الليوسينا (كتسميد عضوى) والتى تمت باستخدام التوافيق المختلفة من : مستوى ارتفاع القرط للأشجار (٣٠،٦٠ سم)، وعدد مرات القرط (٢ ، ٣ / موسم)، والمسافة بين صفوف الأشجار (٣ ، ٥ م). وبعد قرط نباتات الليوسينا تم توزيع ناتج القرط بين خطوط نباتات الذرة، وتم مقارنة انتاج الذرة بين صفوف الليوسينا مع نظائرها بدون أشجار والمسمدة باليوريا.

وكان أهم النتائج المتحصل عليها مايلى :

- تأثر انتاج المادة الجافة لليوسينا معنويا باستخدام معاملات القرط المختلفة، وان كان القرط على ارتفاع ٣٠ سم مرتين/ موسم لنباتات الليوسينا المنزرعة فى خطوط بينها مسافة ٣ م قد أعطى أعلى القيم.
- تأثر محتوى أوراق الليوسينا من النيتروجين والبروتين بمعاملات القرط، وقد أعطى القرط على ارتفاع ٣٠ سم، ثلاث مرات/ موسم بالنسبة للأشجار المنزرعة فى خطوط بينها مسافة ٥ م أفضل النتائج.
- تفوقت نباتات الليوسينا فى محتواها من السليولوز عند القرط على ارتفاع ٦٠ سم، مرتين/ موسم للنباتات المنزرعة على مسافة ٥ م .
- زادت انتاجية الذرة الشامى بعد تسميدها ب ٦٠ كجم نيتروجين/ فدان مقارنة بباقى المعاملات .
- اضافة ناتج القرط نتج عنه انتاجية متوسطة من محصول الذرة الشامية تقارب أو تزيد عن تلك الناتجة عن مستوى ٣٠ كجم/ فدان.
- اضافة ناتج قرط الليوسينا زاد من خصوبة التربة متمثلا فى زيادة المادة العضوية، وتحسين ال pH، ال E.C للتربة.

وبناء عليه يمكن زراعة الذرة الشامى فى هذا النظام من الزراعة خاصة فى الأراضى حديثة الاستصلاح ، وبذلك يمكن خفض استخدام الأسمدة المعدنية، وتقليل التلوث البيئى الناتج عن الاسراف فى استخدامها. هذا ، ويعتبر ناتج التقليم من الليوسينا علف أخضر جيد لارتفاع قيمته الغذائية واستثاغته للحيوان ، و الذى يمكن أن يكون بديلا أو يستخدم بالتبادل مع محاصيل العلف والتى تعانى مصر من نقصها خاصة فى فصل الصيف.

قام بتحكيم البحث

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