Zagazig J.Agric. Res., Vol. 29 No.(6) 2002 1745-1763

RESPONSE OF SOME BERSEEM CULTIVARS TO VARYING SEEDING RATE UNDER AGRO-HORTICULTURAL SYSTEM.

Sarhan, A.A. and M.F. Abd El-Maksoud
Plant Wealth Dept., Efficient Productivity Instit., Zagazig Univ., Egypt.

Received 5 / 11 / 2002 Accepted 20 / 11 / 2002

ABSTRACT: Two field experiments were conducted in sandy soil occupied by mandarin orchard at Wadi EL-Mollak region, Sharkia Governorate during 2000/2001 and 2001/2002 winter seasons to investigate the response of growth, forage yield and yield quality of four berseem cultivars (Giza, 6, ,Gemmiza l, Serw 1 and Local) to three seeding rates (15, 22.5 and to 30 kg/fad.) the twelve treatments (4 cultivars x3 seeding rates) were arranged in factorial experiment by using a randomized complete block design. The results could be summarized as follows:

The cultivar Giza 6 had the tallest plants, more number of branches and leaves per plant, but its dry weight was in the second rank. Also, this cultivar outyielded significantly the other three cultivars in both fresh and dry forage yields, as well as gave the highest starch value (SV) and total digestible nutrients (TDN).

However, Local cultivar showed inferiority to the other three ones in number of branches and leaves as well as dry weight per plant. So, it produced the least fresh or dry forage yields.

Increasing the seeding rate from 15 kg/fad. to double caused significant reduction in number of branches and leaves as well as dry weight per plant, whereas plant weight, fresh and dry forage yields as well as SV and TDN values were increased significantly by any increment of the seeding rate up to 30 kg/fad.

The interaction effect of cultivars x seeding rates on seasonal fresh forage yield and starch value was significant. The results revealed that yields of Giza 6, Serw 1 and Local cultivars showed higher response to raising of seeding rate than that of Gemmiza 1 one.

Giza 6 cv. gave higher SV than that of the other three ones, under the highest seeding rate. SV of Giza 6 cv. responded positively and continuously to increasing the seeding rate while, this value of Gemmiza 1 did not response.

INTRODUCTION

Egyptian investors in the newly reclaimed sandy soils prefer planting orchards to planting vegetables or field crops. Citrus occupy the widest area in Eastern and Western of Nile Delta, in this respect citrus tree takes about 6 or 8 years from transplanting to gain a profitable income.

A new multiple cropping pattern is called Agroforestry " a collective name for land-use systems which woody perennials (tree, shrubs, etc). are grown in association with herbaceous plants (crops, pastures) and livestock in a spatial arrangement, a rotation or both and in which there are both ecological and economic interaction between the tree and non-tree components of the system. Agro-Horticultaral practice is a distinctive arrangement of fruit trees and crops with a specific space and time. It is a new land use system like Agroforestry and alley cropping. which aims to exploit of shared ecological resources. Appropriate agroforestry systems have the potential to: control erosion, maintain soil organic matter and physical properties, promote efficient nutrient cycling and increase food. fuelwood and fodder production (Young, 1989). Also, it could be added that agroforestry has the potential to: weed control specially when multi-cut crops were used, maintain initial soil moisture and improve soil fertility when legume crops are interplanted.

Berseem or Egyptian clover (*Trifolium alexandrinum*, L.) occupies an important role in the agriculture of Egypt where has enabled livestock. It provides high yields of forage of exceptional nutrition value whether consumed directly as pasturage, green-chop, conserved as hay or silage or incroporated into pellets or other feed stuffs. It fixes more than 714000 tons of atmospheric N_2 annually in Egypt EL-Nahrawy *et al.*, (1996). It improves soil structure and tithe, and is important for soil conservation and reclamation (Abd El-Hady, 1993).

In Egypt, some investigations were conducted in this respect. Interplanting lentil

with peach trees was a successful technology to obtain double crops and to increase land and water used efficiency under rain fed conditions (Ashour *et al.*, 1992). The interplanted maize between palm trees produced an additional grain yield as a gain ranged from 78.5 to 80.7% of solid planting (Sarhan, 1994). Under agro-horticultural system, wheat yielded grain ranged from 7.21 to 9.87 ardab/fad. (Sarhan and Hammad, 1995). Peanut achieved of 1060 and 906 kg/fad. as pod yields by interplanted it with the younger (5-6 yrs) and older (10-11 yrs) mandarin trees, respectively (Sarhan, 2001).

Forage yield and quality of Egyptian clover are influenced by many factors including variety, management practices and environmental conditions. Several investigators (Bakheit, 1986 and Abd El-Halim *et al.*, 1998) showed wide variation among cultivars in growth parameters. Cultivars also differ in seasonal fresh and dry yields (Bakheit ., 1986, Younis *et al.*, 1988; Mohamed and Ahmed, 1995 and Abd El-Halim, 1998). The productivity of the tested cultivars in the newly reclaimed sandy soil differed for individual cuttings and seasonal yield (Abd El-Halim *et al.* 1993). Significant differences among Sakha 4, Giza 10 and Giza 15 cultivars as well as Multifoliate strain for fresh and dry forage yields in first and third cuts as well as seasonal forage yields (Bakheit, 2001).

Regarding seeding rate, significant reduction in number of branches/plant in the 2nd and 3rd cutting due to the increase of seeding rate from 15 to 20 or 25 kg/fad. However, the forage yield was significantly increased but, the dry yield was not increased by raising seeding rate (Assey *et al.*, 1980). Sowing 24 kg of berseem seed/fad. gave the highest fresh and dry yields, starch value (SV) and total digestive nutrients (TDN) over the other two rates of 12 and 36 kg/fad. (Hussein *et al.*, 1983). Increasing seeding rate from 15 to 25 kg/fad. increased the fresh forage yield significantly at the first cut and total production of the first season (Aly, 1989). Also, he added that the effect of varying seeding rates was insignificant on dry forage yield, SV and TDN values. Increasing seeding rates of Fahl from 15 to 18.75 kg/fad. significantly increased plant height by 10.3% whereas, dry weight of plants was significantly decreased as seeding rates increased up to 22.5 kg/fad. (EL-Shiekh, 1998).

The aim of this work the Egyptian clover *(Trifolium alexandrinum* L.) which named "berseem" interplanted with mandarin trees as legume crop and the main forage for livestock feeding in winter season, investigate the response of growth, forage yield and yield quality of the tested cultivars to seeding rates and may be some potential of agroforestry achieve.

MATERIALS AND METHODS

Two field experiments were conducted in sandy soil occupied by mandarin *(Citrus roticulate)* orchard at Wadi El-Mollak region – Abo-Hammad Disterct, Sharkia Governorate during two successive seasons i.e. 2000/2001 and 2001/2002.

Each experiment included twelve treatments which were the combinations of four Egyptian clover-berseem – (*Trifolium alexandrinum*, L.) cultivars (Giza 6, Gemmiza 1, Serw 1 and Local) with three seeding rates (15,22.5 and 30 kg/fad.) in a randomized complete block design with three replicates.

Each available area was surrounded by four trees in corners (4 x 4 m apart) to represent one plot, which was about 12.86 m^2 (16-3.14 m^2 below mandarin tree). Age of trees was 7 and 8 years old and the average of the tree dimensions was 1.45 and 1.52 m for tree diameter, 1.86 and 1.97 m for tree height. Light intensity was determined above berseem canopy and at a distance of 1 m from the tree trunk was 5163 and 5008 lux in the first and second seasons, in a respective order.

Berseem seeds were sown on 25th of October 2000 and 28th of October 2001, phosphorus was applied at 100 kg/fad. in the form of calcium super phosphate (15.5% P_2O_5) at seeding date. Seeds were treated by suitable strain of *Rhizobium trifolti* and broadcasted on dry soil at the studied seeding rate followed by irrigation. The prevailing agronomic practices in the region were applied.

Four cuts were taken: the first after 59 days from sowing; the second after 54 days from the first; the third after 38 days from the second and the fourth after 38 days from the third.

A random samples of 20 plants were taken by hand half of them were in about 1.25 and the other half in about 1.75 m from the tree trunk. Thereafter, plant height (cm), number of vegetative branches and green leaves per

plant were determined. Plants were dried at 65°C until reaching stability of weight which was recorded in grams.

Fresh and dry forage yields (ton/fad) were estimated after cutting whole plot by hand-sickle to a stubble height of 8 cm.

In order to estimate the forage quality, starch value (SV) and total digestible nutrients (TDN) in kg/fad were calculated according the following formula. Abou-Raya *et al.*, (1981).

SV = 0.435 DMP + 1.20

TDN = 0.625 DMP – 0.15

Where DMP is the dry matter percentage which was determined by drying a sample of 200 g taken from chopped forage in ventilated oven at 65 °C until reached stability of weight.

All data were statistically analyzed according to the method described by Snedecor and Cochran (1967). Significant differences among means were judged with the help of Duncan's multiple range test (Duncan, 1955). In interaction Tables, capital and small letters were used to compare rows and columns means, respectively.

RESULTS AND DISCUSSION

1- Growth:

Some of berseem growth parameters as influenced by different seeding rates as shown in Tables 1 and 2.

Plant height of the four cultivars differed from one to another. These differences were significant. The cultivar Giza 6 had the tallest plants throughout the four cuts. In the first and the third cuts cultivar Local shared Giza 6 same postion and Serw 1 cultivar replaced Local cultivar and had taller plants. Giza 6 cultivar continued to have more number of branches per plant throughout the different cuts but Locial cultivar had the lowest number. Gemmiza 1 as well as Serw 1 cvs. stood in between. In Table 2 Local cultivar showed inferiority to the other three in number of leaves per plant as well as dry weight per plant. Leaf number per plant of Giza 6 was the highest but its dry weight was in the second postion indicating smaller size of its leaves as well as thinner plants since it was the tallest variety. These results are in agreement with those obtained by Shukla (1988), Abdel-Gawad (1993), El-Debaby *et al.*, (1994), Nabila and Ahmed (1995),

Table 1: Plant height (cm) and number of branches per plant of some berseem varieties as influenced by seeding rate under Agro-Horticultural system.

Main effects and interaction	2000/2001 season				2001/2002 season				Combined analysis			
	1st cut	2nd cut	3rd cut	4th cut	1st cut	2nd cut	3rd cut	4th cut	1st cut	2nd cut	3rd cut	4th cut
	Plant height (cm)											
Berseem cultivar (C):												
Giza 6	32.8^{ab}	56.3^{a}	57.8^{a}	55.9^{a}	34.7^{a}	54.0	56.8^{a}	54.9^{a}	33.7^{a}	55.1^{a}	57.3^{a}	55.4^{a}
Gemmiza 1	33.2^{ab}	53.9^{ab}	52.8^{bc}	51.0^{b}	34.9^{a}	52.0	52.0^{c}	50.6^{b}	34.0^{a}	52.9^{b}	52.4^{b}	50.8^{b}
Serw 1	31.8^{b}	50.9^{b}	51.7^{c}	56.8^{a}	32.4^{b}	51.7	54.7^{b}	51.6^{b}	32.1^{b}	51.3^{b}	53.2^{b}	55.2^{a}
Local	34.1^{a}	52.8^{b}	55.9^{ab}	52.2^{b}	34.7^{a}	53.5	56.7^{a}	52.1^{b}	34.4^{a}	53.2^{ab}	56.4^{a}	52.1^{b}
F-test	*	**	**	**	**	N. S.	**	**	**	**	**	**
Seeding rate (S):												
15.0 kg/ fad.	31.4^{c}	51.4^{b}	52.8^{b}	50.8^{c}	32.6^{d}	50.6^{b}	52.4^{b}	48.9^{c}	32.0^{c}	51.0^{c}	52.7^{c}	49.9^{c}
22.5 kg/ fad.	32.7^{b}	52.4^{b}	54.3^{ab}	53.7^{b}	33.3^{b}	53.4^{a}	55.7^{a}	52.7^{b}	33.0^{b}	52.9^{b}	55.0^{b}	53.2^{b}
30.0 kg/ fad.	34.8^{a}	56.6^{a}	56.5^{a}	57.3^{a}	36.2^{a}	54.5^{a}	57.0^{a}	55.4^{a}	35.5^{a}	55.6^{a}	56.8^{a}	56.4^{a}
F-test	**	**	*	**	**	**	**	**	**	**	**	**
Interaction:												
C x S	N. S.	*	*	**	**	N. S.	*	**	**	**	**	**
	Number of branches per plant											
Berseem cultivar (C):												
Giza 6	-	4.03^{a}	3.23^{a}	4.25^{a}	-	3.78^{a}	2.90^{b}	4.13^{a}	-	3.91^{a}	3.07^{a}	4.19^{a}
Gemmiza 1	-	3.47^{b}	2.93^{b}	3.71^{a}	-	2.76^{c}	3.00^{b}	3.50^{bc}	-	3.11^{b}	2.96^{a}	3.60^{b}
Serw 1	-	3.92^{a}	3.04^{ab}	4.07^{a}	-	3.32^{b}	3.30^{a}	3.86^{ab}	-	3.62^{a}	3.17^{a}	3.96^{ab}
Local	-	3.16^{b}	2.40^{c}	2.60^{b}	-	3.43^{ab}	2.46^{c}	3.31^{c}	-	3.29^{b}	2.43^{b}	2.95^{c}
F-test	-	**	**	**	-	**	**	**	-	**	**	**
Seeding rate (S):												
15.0 kg/ fad.	-	4.33^{a}	3.27^{a}	4.05^{a}	-	3.71^{a}	3.05^{a}	4.38^{a}	-	4.03^{a}	3.17^{a}	4.03^{a}
22.5 kg/ fad.	-	3.41^{b}	2.77^{b}	3.68^{ab}	-	3.25^{b}	2.91^{ab}	3.44^{b}	-	3.33^{b}	2.84^{b}	3.56^{b}
30.0 kg/ fad.	-	3.20^{b}	2.65^{b}	3.25^{b}	-	3.01^{b}	2.78^{b}	3.28^{b}	-	3.11^{b}	2.72^{b}	3.27^{b}
F-test	-	**	**	*	-	**	*	**	-	**	**	**
Interaction:												
C x S	-	N. S.	*	N. S.		*	N.S.	*	-	*	*	N.S.

** = P < 0.01, * = P < 0.05 and NS = Not significant

Table 2: Number of leaves per plant and dry weight for ten plants(g) of some berseem varieties as influenced by seeding rate under Agro-Horticultural system.

Main effects and interaction	2000/2001 season				2001/2002 season				Combined analysis			
	1st cut	2nd cut	3rd cut	4th cut	1st cut	2nd cut	3rd cut	4th cut	1st cut	2nd cut	3rd cut	4th cut
	Number of leaves per plant											
Berseem cultivar (C):												
Giza 6	4.56	13.77^{a}	16.64^{ab}	21.22^{a}	4.92^{ab}	14.30^{a}	16.54^{a}	21.84^{a}	4.74^{a}	14.04^{a}	16.59^{ab}	21.53^{a}
Gemmiza 1	4.72	14.93^{a}	16.34^{b}	21.13^{a}	4.30^{c}	13.00^{b}	16.41^{a}	19.89^{b}	4.51^{b}	13.97^{a}	16.38^{b}	20.50^{ab}
Serw 1	4.59	13.92^{a}	17.79^{a}	19.43^{a}	5.02^{a}	14.70^{a}	17.29^{a}	19.03^{b}	4.81^{a}	14.31^{a}	17.54^{a}	19.20^{b}
Local	4.42	11.94^{b}	14.42^{c}	15.98^{b}	4.54^{bc}	11.60^{c}	14.37^{b}	18.91^{b}	4.48^{b}	11.77^{b}	14.40^{c}	17.47^{c}
F-test	N.S.	**	**	**	**	**	**	**	**	**	**	**
Seeding rate (S):												
15.0 kg/ fad.	4.99^{a}	16.15^{a}	18.24^{a}	23.98^{a}	5.25^{a}	14.51^{a}	17.26^{a}	23.00^{a}	5.12^{a}	15.33^{a}	17.75^{a}	23.45^{a}
22.5 kg/ fad.	4.47^{b}	12.88^{b}	15.97^{b}	19.04^{b}	4.48^{b}	13.42^{b}	15.96^{b}	19.71^{b}	4.48^{b}	13.16^{b}	15.96^{b}	19.35^{b}
30.0 kg/ fad.	4.25^{b}	11.89^{b}	14.68^{c}	15.31^{c}	4.35^{b}	12.25^{c}	15.23^{b}	17.05^{c}	4.30^{b}	12.08^{c}	14.96^{c}	16.22^{c}
F-test	**	**	**	**	**	**	**	**	**	**	**	**
Interaction:												
C x S	*	**	N. S.	**	N. S.	N. S.	N. S.	**	*	**	N. S.	**
	Dry weight of plant (g)											
Berseem cultivar (C):												
Giza 6	0.189^{a}	2.165^{a}	1.132^{a}	1.105^{b}	0.176	2.302	1.149^{a}	1.289^{b}	0.183^{a}	2.233	1.141^{a}	1.197^{b}
Gemmiza 1	0.148^{b}	2.090^{a}	1.038^{b}	1.284^{a}	0.163	1.965	1.032^{b}	1.370^{a}	0.156^{b}	2.027	1.035^{b}	1.327^{a}
Serw 1	0.135^{b}	2.112^{a}	0.949^{c}	1.300^{a}	0.162	2.566	1.141^{a}	1.419^{a}	0.149^{b}	2.339	1.045^{b}	1.359^{a}
Local	0.150^{b}	1.885^{b}	.0732^{d}	1.015^{b}	0.164	1.943	0.822^{c}	1.168^{c}	0.158^{b}	1.914	0.777^{c}	1.092^{c}
F-test	**	**	**	**	N. S.	N. S.	**	**	**	N. S.	**	**
Seeding rate (S):												
15.0 kg/ fad.	0.183^{a}	2.340^{a}	1.155^{a}	1.394^{a}	0.202^{a}	2.244	1.187^{a}	1.467^{a}	0.193^{a}	2.292	1.171^{a}	1.431^{a}
22.5 kg/ fad.	0.147^{b}	1.996^{b}	0.928^{b}	1.074^{b}	0.158^{b}	2.017	1.004^{b}	1.244^{b}	0.153^{b}	2.006	0.967^{b}	1.159^{b}
30.0 kg/ fad.	0.137^{b}	1.853^{c}	0.805^{c}	1.060^{b}	0.140^{c}	2.321	0.916^{c}	1.224^{b}	0.139^{c}	2.087	0.861^{c}	1.143^{b}
F-test	**	**	**	**	**	N. S.	**	**	**	N. S.	**	**
Interaction:												
C x S	N. S.	N. S.	**	*	*	N. S.	N. S.	*	*	N. S.	**	**

** = P < 0.01, * = P < 0.05 and NS = Not significant

Gaballah (1996) and Soliman (2000).

Growth of the individual plant of berseem was influenced by the change of seeding rate. Increasing the seeding rate from 15 kg/fad. to double caused significant reduction in number of branches per plant and number of leaves per plant and caused significant increase in plant height. The net result was a significant decrease in dry weight of the single plant. This increase in plant height was on the cost of plant girth and thinner plants were produced. Similar results were found by Badr *et al.*, (1975), Assey *et al.*, (1980), Shabaan *et al.*, (1984) and El-Sheikh (1998).

The interaction effect between cultivars and seeding rates on number of branches / plant was significant at the second and third cuts (Table. 1 as well as Figs. and 2).

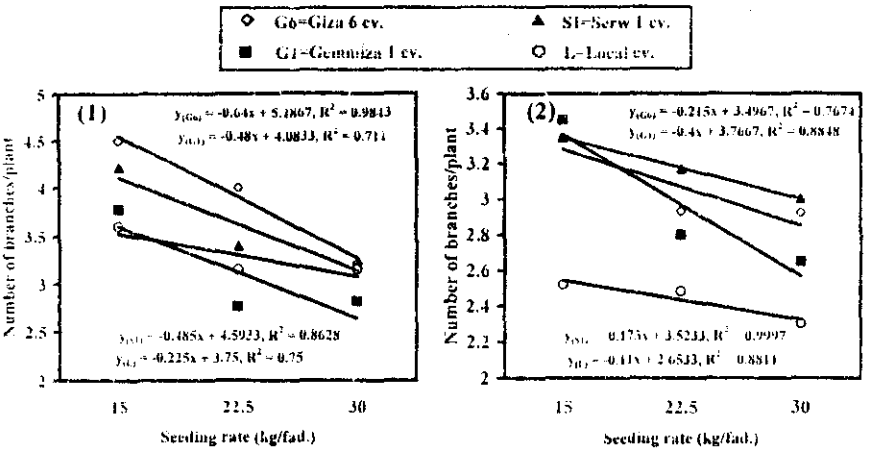
It is evident that the four tested cultivars responded negatively to the increase of seeding rate from 15 to 30 kg/fad., however, the regression coefficient of branches number/plant due to increasing the seeding rate was much more higher in Giza 6 cv. (b = - 0.64) at the second cut and in Gemmiza 1 one (b = - 0.4) at the third cut. Whereas, number of branches per Local cv. Plant did not vary significantly due to changing seeding rate (b = - 0.225 and – 0.11) at the second and third cuts, respectively.

Also, dry weight/plant was influenced significantly by the interaction of the two investigated factors at the third and fourth cuts (Table. 2 as well as Figs. 3 and 4). It is a vile interesting to note that each increment in seeding rate caused a significant decrease in dry weight/plant of Giza 6 cv. (b = - 0.23 and -0.189) as well as of Serw 1 cv. (b = - 0.165 and - 0.212) at the third and fourth cuts, in respective order. However, this trait of Local cv. was not effective in this respect (b = - 0.071 and- 0.067) at the mentioned cuts.

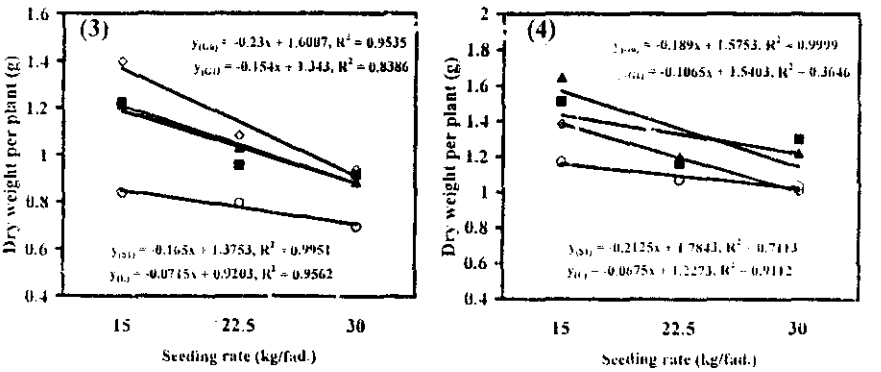
2- Fresh and dry forage yields:

Fresh and dry forage yields as recorded in tons per faddan and influenced by various seeding rates are shown in Table 3.

The cultivar Giza 6 outyielded significantly the other three cultivars in both fresh and dry forage yields. This was a picture in all cuts and in the total yield as well. Both Gemmiza 1 and Serw 1 cultivars have the second rank and the Local one was the most inferior when proeduced the least fresh and dry forage



Figs. 1 and 2: Illustrate response of number of branches per berseem plant to seeding rate for Giza 6 (G6), Gemmiza 1 (G1), Serw 1 (S1) and Local (L) cultivars at the 2nd and 3rd cuts, respectively.



Figs. 3 and 4: Illustrate response of dry weight per berseem plant to seeding rate for Giza 6 (G6), Gemmiza 1 (G1), Serw 1 (S1) and Local (L) cultivars at the 3rd and 4th cuts, respectively.

Table 3: Fresh forage yield (ton/fad.) and dry forage yield (ton/fad.) of some berseem varieties as influenced by seeding rate under Agro-Horticultural system.

Main effects and interaction	2000/2001 season					2001/2002 season					Combined analysis				
	1st cut	2nd cut	3rd cut	4th cut	Total	1st cut	2nd cut	3rd cut	4th cut	Total	1st cut	2nd cut	3rd cut	4th cut	Total
Berseem cultivar (C):							**Fresh forage yield (ton/fad.)**								
Giza 6	4.63^{a}	5.61^{b}	8.18^{a}	6.50^{a}	24.92^{a}	5.28^{a}	5.20^{a}	7.99^{a}	6.66^{a}	25.13^{a}	4.96^{a}	5.41^{a}	8.08^{a}	6.58^{a}	25.02^{a}
Gemmiza 1	4.01^{b}	6.28^{a}	7.35^{b}	4.95^{c}	22.59^{b}	4.29^{b}	4.30^{b}	7.78^{a}	5.60^{b}	21.97^{c}	4.15^{c}	5.29^{ab}	7.57^{a}	5.28^{c}	22.28^{b}
Serw 1	4.19^{b}	5.26^{b}	6.81^{b}	5.64^{b}	21.90^{b}	5.11^{a}	4.65^{ab}	6.96^{b}	6.28^{a}	23.00^{b}	4.65^{ab}	4.96^{b}	6.88^{b}	5.96^{b}	22.45^{b}
Local	4.37^{ab}	5.60^{b}	6.97^{b}	5.03^{c}	21.97^{b}	4.40^{b}	4.45^{b}	6.85^{b}	5.27^{b}	20.97^{d}	4.39^{bc}	5.03^{b}	6.91^{b}	5.15^{c}	21.47^{c}
F-test	*	*	**	**	**	**	*	**	**	**	**	**	**	**	**
Seeding rate (S):															
15.0 kg/ fad.	3.60^{b}	4.90^{c}	6.43^{b}	4.95^{c}	20.27^{c}	4.23^{b}	4.13^{b}	6.45^{c}	5.36^{c}	20.17^{c}	4.11^{c}	4.52^{b}	6.44^{b}	5.15^{c}	20.22^{c}
22.5 kg/ fad.	4.18^{b}	5.76^{b}	7.66^{a}	5.40^{b}	23.00^{b}	5.01^{a}	4.78^{a}	7.57^{b}	5.82^{b}	23.27^{b}	4.60^{b}	5.31^{a}	7.62^{a}	5.61^{b}	23.14^{b}
30.0 kg/ fad.	4.71^{a}	6.40^{a}	7.90^{a}	6.26^{a}	25.30^{a}	5.08^{a}	4.95^{a}	8.17^{a}	6.68^{a}	24.88^{a}	4.91^{a}	5.68^{a}	8.03^{a}	6.47^{a}	25.09^{a}
F-test	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**
Interaction:															
C x S	N. S.	N. S.	N. S.	N. S.	*	*	N. S.	N. S.	N. S.	**	*	N. S.	N. S.	N. S.	**
							Dry forage yield (ton/fad.)								
Berseem cultivar (C):															
Giza 6	0.465^{a}	0.846^{b}	0.824^{a}	0.849^{b}	2.984	0.525^{a}	0.938^{a}	0.791^{a}	0.964^{a}	3.218^{a}	0.495^{a}	0.892^{ab}	0.808^{a}	0.907^{a}	3.101^{a}
Gemmiza 1	0.405^{b}	1.025^{a}	0.780^{ab}	0.743^{c}	2.953	0.423^{b}	0.814^{b}	0.796^{a}	0.938^{ab}	2.971^{b}	0.414^{c}	0.919^{a}	0.788^{a}	0.841^{b}	2.962^{b}
Serw 1	0.405^{b}	0.837^{b}	0.702^{c}	0.936^{a}	2.880	0.505^{a}	0.802^{b}	0.750^{ab}	0.881^{b}	2.938^{b}	0.455^{b}	0.820^{ab}	0.726^{b}	0.908^{ab}	2.909^{b}
Local	0.442^{ab}	0.867^{b}	0.749^{bc}	0.803^{bc}	2.861	0.427^{b}	0.759^{b}	0.709^{b}	0.965^{ab}	2.860^{b}	0.435^{bc}	0.813^{b}	0.729^{b}	0.884^{ab}	2.861^{b}
F-test	*	*	**	**	N. S.	**	*	*	*	**	**	**	**	**	**
Seeding rate (S):															
15.0 kg/ fad.	0.404^{b}	0.835^{b}	0.688^{b}	0.798^{b}	2.725^{c}	0.421^{b}	0.798	0.683^{b}	0.930	2.832^{b}	0.413^{b}	0.817	0.686^{b}	0.864^{b}	2.780^{c}
22.5 kg/ fad.	0.427^{ab}	0.901^{ab}	0.784^{a}	0.814^{ab}	2.926^{b}	0.500^{a}	0.845	0.773^{a}	0.908	3.026^{a}	0.463^{a}	0.873	0.778^{a}	0.861^{b}	2.976^{b}
30.0 kg/ fad.	0.457^{a}	0.944^{a}	0.819^{a}	0.887^{a}	3.107^{a}	0.490^{a}	0.841	0.829^{a}	0.983	3.143^{a}	0.474^{a}	0.893	0.824^{a}	0.935^{a}	3.125^{a}
F-test	*	*	*	*	**	**	N. S.	**	N. S.	**	**	N. S.	**	*	**
Interaction:															
C x S	N. S.	N. S.	N. S.	N. S.	N. S.	N. S.	N. S.	N. S.	N. S.	N. S.	**	N. S.	N. S.	N. S.	N. S.

** = P < 0.01, * = P < 0.05 and NS = Not significant

yields. These results are in accordance with those reported by Bakheit (1986), Younis *et al.*, (1988), Abd El-Halim *et al.*, (1993), Abd El-Halim *et al.*, (1998) and Bakheit (2001).

The increases in fresh yield/fad. were about 16.5, 3.7 and 4.5% as well as in dry forage yield/fad. were about 8.3, 3.5 and 1.6% for Giza 6, Gemmiza 1 and Serw cultivars compared with local one, in a respective order. The superiority of Giza 6 cultivar was observed earlier in its plant height, number of branches/plant and its leaf number per plant. The cultivar Local was inferior in growth as monitered in all the growth parameters showed in Tables 1 and 2.

The negative effect of increasing seeding rate from 15 kg/fad. to 22.5 and then to 30 kg/fad. could by compensated for by the increase in number of plants per unit area of land produced by higher seeding rate. A secequent increase in forage yield fresh or dry was observed. The significant increase in fresh forage yield amounted to 14.4 and 24% resulted from the increase in seeding rate from 15 to 22.5 and 30 kg/fad., respectively. These two figures were 7 and 12.4% for dry forage yield. The differences between fresh and dry forage figures may be due to moisture content which may be higher in the dense planting. Finally, the effect of varying seeding rates on fresh and dry yields was significant in all the cuts, and their totals except the second cut of the dry yield through a trend could be observed. Sowing 25 or 24 kg/fad. gave the highest fresh and dry yields in clay soils (Assey *et al.*, 1980 and Hussein *et al.*, 1983), in respective order.

The four cultivars responded differently to the various seeding rates as seen in the interaction effect of cultivars x seeding rates on seasonal fresh forage yield as shown in Table 3 a.

From Table 3a, it could e seen that the effect of seeding rates on forage yield (fresh) was the same for Giza 6, Serw 1 and Local cultivars and resembles the main effect i.e. the three cultivars responded positively to the increase in seeding rate. Meanwhile, fresh forage yield / fad. of Gemmiza 1 responded positively only up to 22.5 kg seeds/fad. on the other direction. Giza 6 cv. outyielded the other three irrespective to the seeding rate. Under the medium rate (22.5 kg/fad.), the other three cultivars

were at par with each other. Under the low seeding rate (15 kg/fad.) Gemmiza 1 outyielded the other two and under the dense planting (30 kg/ fad.) Serw 1 surpassed the other two. These results were supported by linear regressions in Fig.5.

Table 3a: The interaction effect of berseem cultivars and seeding rates on seasonal fresh forage yield (ton/fad.).

Berseem Cultivars:	Seeding rates (kg/fad.) 15.0	22.5	30.0
	C	B	A
Giza 6	21.46 a	24.97 a	28.52 a
	B	A	A
Gemmiza 1	20.58 b	22.75 b	23.56 c
	C	B	A
Serw 1	19.39 c	22.91 b	25.11 b
	C	B	A
Local	19.32 c	21.96 b	23.18 c

3- Forage quality:

Starch value (SV) and total digestible nutrients (TDN) recorded in kg/fad. of berseem cultivars as influenced by seeding rates are shown in Table 4.

The cultivar Giza 6 continued to be the superior cultivar. It gave the highest starch value and total digestible nutrients as compared with the other three cultivars. They gave similar total of SV and TDN values. This was expected since Giza 6 cultivar gave the highest dry forage yield and these quality values are functions of dry matter content of fresh forage. The differences among the three cultivars studied in both SV and TDN were significant and Giza 15 cv. had always the highest values followed by Serw 1 and Sakha 4 in a descending order (Gaballah, 1996). Synthetic 79 and Ahhaly were the best cultivars for SV and TDN values in both seasons, followed by Helaly one. Whereas, Serw 1 cultivar gave the lowest values in this respect (Soliman, 2000).

Similarly, the effect of seeding rates on forage quality

Table 4: Starch value (kg/fad.) and total digestible nutrients (kg/fad.) of some berseem varieties as influenced by seeding rate under Agro-Horticultural system.

Main effects and interaction	2000/2001 season					2001/2002 season					Combined analysis				
	1st cut	2nd cut	3rd cut	4th cut	Total	1st cut	2nd cut	3rd cut	4th cut	Total	1st cut	2nd cut	3rd cut	4th cut	Total
Berseem cultivar (C):						**Starch value (kg/fad.)**									
Giza 6	258^{a}	435^{b}	457^{a}	447^{ab}	1598	292^{a}	470^{a}	440^{a}	504^{a}	1707^{a}	275^{a}	452^{ab}	449^{a}	476^{a}	1683^{a}
Gemmiza 1	224^{b}	521^{a}	427^{ab}	382^{c}	1556	235^{b}	405^{b}	440^{a}	475^{ab}	1557^{b}	230^{c}	463^{a}	434^{a}	428^{b}	1555^{b}
Serw 1	226^{b}	427^{b}	387^{b}	475^{a}	1516	281^{a}	405^{b}	409^{ab}	459^{b}	1555^{b}	254^{b}	416^{b}	398^{b}	467^{a}	1535^{b}
Local	245^{ab}	442^{b}	410^{b}	409^{bc}	1509	238^{b}	383^{b}	390^{b}	483^{ab}	1496^{b}	241^{bc}	414^{b}	400^{b}	446^{ab}	1501^{b}
F-test	*	**	**	**	N.S.	**	*	*	*	**	**	**	**	**	**
Seeding rate (S):															
15.0 kg/ fad.	224^{b}	422^{b}	376^{b}	406^{b}	1429^{c}	234^{b}	396	374^{c}	469^{b}	1474^{c}	229^{b}	409	375^{c}	438^{b}	1451^{c}
22.5 kg/ fad.	236^{ab}	461^{ab}	433^{a}	419^{b}	1549^{b}	274^{a}	426	427^{b}	464^{b}	1596^{b}	255^{a}	443	430^{b}	442^{b}	1570^{b}
30.0 kg/ fad.	256^{a}	488^{a}	451^{a}	461^{a}	1655^{a}	278^{a}	425	458^{a}	508^{a}	1666^{a}	267^{a}	457	454^{a}	485^{a}	1663^{a}
F-test	**	*	**	*	**	**	N. S.	**	*	**	**	N. S.	**	**	**
Interaction:															
C x S	N. S.	N. S.	N. S.	N. S.	N.S.	N. S.	N. S.	N. S.	N. S.	N. S.	*	N. S.	N. S.	N. S.	*
Berseem cultivar (C):						**Total digestible nutrients (kg/fad.)**									
Giza 6	284^{a}	520^{b}	503^{a}	521^{b}	1829	320^{a}	579^{a}	482^{a}	600^{a}	1982^{a}	302^{a}	550^{a}	492^{a}	561^{a}	1905^{a}
Gemmiza 1	247^{b}	631^{a}	476^{ab}	457^{c}	1812	258^{b}	502^{b}	486^{a}	578^{ab}	1825^{b}	253^{c}	566^{a}	481^{a}	518^{b}	1818^{b}
Serw 1	247^{b}	515^{b}	428^{c}	576^{a}	1767	308^{a}	494^{b}	458^{ab}	541^{b}	1802^{b}	278^{b}	504^{ab}	443^{b}	559^{a}	1784^{b}
Local	270^{ab}	533^{b}	458^{bc}	494^{bc}	1756	260^{b}	467^{b}	433^{b}	595^{ab}	1756^{b}	265^{bc}	500^{b}	446^{b}	545^{ab}	1756^{b}
F-test	*	**	*	**	N.S.	**	*	*	*	**	**	**	**	**	**
Seeding rate (S):															
15.0 kg/ fad.	247^{b}	515	420^{b}	491^{b}	1674^{c}	256^{b}	492	417^{b}	573	1740^{b}	252^{b}	503	419^{b}	532^{b}	1706^{c}
22.5 kg/ fad.	261^{ab}	554	478^{a}	508^{ab}	1795^{b}	298^{a}	521	472^{a}	559	1857^{a}	280^{a}	537	475^{a}	530^{b}	1822^{b}
30.0 kg/ fad.	278^{a}	580	501^{a}	545^{a}	1904^{a}	305^{a}	518	505^{a}	604	1927^{a}	292^{a}	549	503^{a}	574^{a}	1916^{a}
F-test	*	N. S.	**	*	**	**	N. S.	**	N. S.	**	**	N. S.	**	*	**
Interaction:															
C x S	N. S.	N. S	N. S.	N. S.	N.S.	N. S.	N. S.	N. S.	N. S.	N. S.	**	N. S.	N. S.	N. S.	N. S

** = P < 0.01, * = P < 0.05 and NS = Not significant

monitored in starch value and total digestible nutrients was significant. Increasing seeding rate from 15 to 22.5 and to 30 kg/fad. caused significant increases in these two quality parameters. The starch value increased by 8.7 and 14.6% due to the increase in seeding rate from 15 to 22.5 and to 30 kg/fad., respectively, whereas these figures were 6. 8 and 12.3% for total digestible nutrients. These figures do not differ much from those of dry forage yield and this is expected since these two parameters are functions of the dry matter content. Under clay soil condition, sowing 24 kg seeds/fad. significantly surpassed the rates of 12 and 36 kg seed/fad. in starch value and total digestible nutrients (Hussien *et al.*, 1983). Whereas, Aly (1989) reported that the effect of seeding rates was insignificant on SV and TDN values.

The four cultivars showed differential response to increasing seeding rate as shown in Table 4a, where the interaction effect of cultivars x seeding rates on starch value is presented.

The cultivar Giza 6 outyielded the other three cultivars only under the dense rate (30 kg/fad.). On the other hand seasonal starch value of Giza 6 cultivar was increased by any increment of seeding rate over than 15 kg, the cultivar Gemmiza 1 was not affected and the starch value of both Serw 1 and Local cultivars responded only to the increase in seeding rate to 22.5 kg/fad. Linear regressions in Fig. 6 support these findings.

Table 4a: The interaction effect of berseem cultivars and seeding rates on seasonal starch value (kg/fadl).

Berseem cultivars:	**Seeding rates (kg/fad.)**		
	15.0	**22.5**	**30.0**
	C	B	A
Giza 6	1487 a	1626 a	1846 a
	A	A	A
Gemmiza 1	1498 a	1579 a	1592 b
	B	A	A
Serw 1	1406 a	1552 a	1649 b
	B	A	A
Local	1416 a	1535 a	1557 b

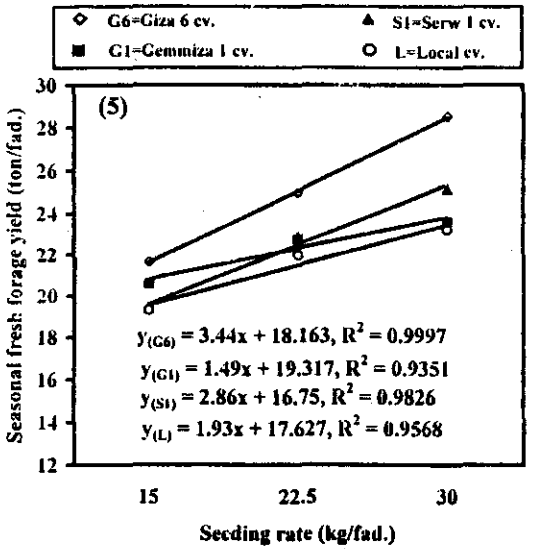


Fig. 5: Illustrates response of seasonal fresh forage yield (ton/fad.) to seeding rate for Giza 6 (G6), Gemmiza 1 (G1), Serw 1 (S1) and Local (L) berseem cultivars.

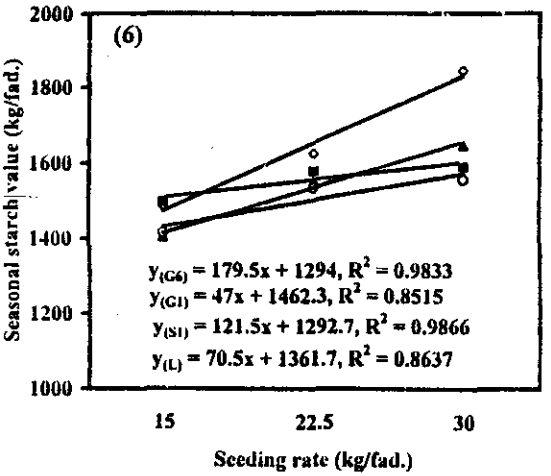


Fig. 6: Illustrates response of seasonal starch value (kg/fad.) to seeding rate for Giza 6 (G6), Gemmiza 1 (G1), Serw 1 (S1) and Local (L) berseem cultivars.

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استجابة بعض أصناف البرسيم المصرى لمعدلات التقاوى تحت نظام الزراعة المتداخلة مع أشجار الفاكهة

على عبد العظيم سرحان ، مجدى فتحى عبد المقصود

قسم الثروة النباتية – معهد الكفاية الإنتاجية – جامعة الزقازيق – مصر

أقيمت تجربتان حقليتان فى أرض رملية منزرعة بأشجار يوسفى بعمر (٧و ٨ سنوات) بمنطقة وادى الملاك بمحافظة الشرقية خلال الموسمين الشتويين ٢٠٠٠/٢٠٠١، ٢٠٠١/٢٠٠٢ لمعرفة استجابة نمو ومحصول العلف وجودته لأربعة أصناف للبرسيم المصرى متعدد الحشات (جيزة –٦، جميزة–١، سرو–١ ومحلى) لزيادة معدل التقاوى (من ١٥ إلى ٢٢,٥ وإلى ٣٠ كجم/فدان). وزعت الإتنتى عشرة معاملة لتوليفات عاملى الدراسة فى تجربة عاملية نفذت بتصميم القطاعات العشوائية الكاملة.

ويمكن تلخيص أهم النتائج فيما يلى:

١- تميز الصنف جيزة ٦ بأن نباتاته كانت الأطول والأكثر تفريعا وتحمل عدد أوراق أكثر من الأصناف الأخرى فى حين احتل المرتبة الثانية فى الوزن الجاف للنبات وكذلك تفوق هذا الصنف معنويا فى كل من محصول العلف الأخضر والجاف (طن/فدان) والقيمة الغذائية (معامل النشا ومجموع المركبات الغذائية المهضومة - كجم/فدان).

٢-حقق الصنفان جيزة ١ وسرو ١ المرتبة الثانية لمحصولى العلف الأخضر والجاف،بينما سجل الصنف المحلى أدنى القيم لكل من عدد الفروع والأوراق والوزن الجاف للنبات ومن ثم أعطى أقل محصول علف سواء أخضر أو جاف.

٣- تسببت زيادة معدل التقاوى من ١٥ كجم/فدان إلى الضعف فى حدوث نقص معنوي لكل من عدد الفروع، عدد الأوراق والوزن الجاف للنبات بينما ازداد معنويا كل من ارتفاع النبات (سم) ومحصولى العلف الأخضر والجاف وكذلك معامل النشا ومجموع المركبات الغذائية المهضومة لكل إضافة فى معدل التقاوى.

٤- كان تأثير تداخل الفعل للأصناف مع معدلات التقاوى معنويا لكل من إجمالي محصول العلف الأخضر و معامل النشا (للمتوسط التجميعى للموسمين)، حيث أوضحت النتائج ما يلى:

أ- أن استجابة الإجمالي السنوي لمحصول العلف لكل من جيزة ٦، سروا والمحلى لزيادة معدل التقاوى كانت أعلى وحتى ٣٠كجم/فدان بينما كانت استجابة إجمالى محصول الصنف جميزة ١ كانت أقل حتى ٢٢,٥كجم/فدان فقط.

ب- سجل الصنف جيزة ٦ أعلى محصول علف أخضر من الفدان مع معدلات التقاوى المستخدمة.

جـ- حقق الصنف جيزة ٦ معامل نشا أعلى من الأصناف الأخرى عند استخدام أعلى معدل تقاوى. كذلك استجاب معامل النشا للصنف جيزة ٦ طرديا وباستمرار لزيادة معدل التقاوى فى حين لم يستجيب معامل النشا للصنف جميزة ١.

توصى الدراسة بإمكانية الحصول على أكثر من ٢٨ طن/فدان من العلف الأخضر و ١٨٠٠ كجم/فدان معامل نشا بزراعة صنف البرسيم المصري متعدد الحشات (جيزة ٦) بمعدل تقاوى ٣٠كجم/فدان محملا على أشجار اليوسفي (عمر ٧-٨ سنوات) في الأراضي الرملية المستصلحة حديثا.