PRODUCTIVITY OF FODDER BEET ON SANDY SOIL IN EGYPT

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ABSTRACT
Farmyard manure effect on the productivity of five fodder beet varieties grown on sandy soil was investigated during three successive seasons. It was revealed from the results that FYM can effectively convert the non-productive sandy soil to a relatively productive soil. FYM application resulted in an increase of 145, 97, 55, 40, 39 and 43% for dry matter. Fresh matter, germination percentage, plant height, root length and root diameter, respectively, averaged over varieties and seasons.

KEYWORDS
Fodder beet, organic matter, farmyard manure, sandy soil.

INTRODUCTION

In Egypt, animal production is severely limited by marked seasonal feed deficits. There is a shortage of fresh forages particularly during summer. Moreover, the cultivated area is very limited and is devoted to cultivation of strategic food crops such as wheat and faba beans during winter. Considerable areas in Sinai, at the northern coast and new reclaimed soils are the only land available where we can expand in forage production. These newly reclaimed lands are mostly sandy soils which are characterized by limited available nutrients and poor water holding capacity as well as a rapid turnover of organic materials (Antoun, 1978). Incorporation of organic materials to sandy soils could greatly improve soil properties and productivity (Antoun *et al.,* 1991). Fodder beet (*Beta vulgaris* L.) is one of the promising forage crops which is not only recommended as a good source for energy for dairy cows (Gaivoronskii, 1981) but also is fit for cultivation on marginal soils such as saline soil (Abou El- Hassan *et al.*, 1971; Rammah *et al.*, 1984). Fodder beet is cultivated as an annual winter crop. The objectives of this study were to evaluate the suitability, practicality and productivity of some introduced fodder beet varieties on sandy soil and the effect of applying farmyard manure (FYM) on the productivity of these varieties.

MATERIALS AND METHODS

Five fodder beet varieties; Beta Voroshenger, Monovert, Magnum, White Giant Green Top and Monofix, were planted on sandy soil at Ismailia Research Station. Physical and chemical properties of soil are shown in Table 1. The field trials were conducted for three successive seasons, 1993/94,1994/95 and 1995/96 and seeded on October 19*th*, November 3*rd* and October 18*th*, respectively. The experimental areas received the usual cultural practices, i.e., ploughing and harrowing then ridging to suitable plots in the three seasons. Ca superphosphate (15.5 % P_2O_5) was added when preparing the soil with rate of 476 kg/ha. Plots were arranged in split plots with 72 m^3 FYM/ha vs. no FYM as main plot treatments and the varieties in sub-plots in a randomized complete block design with four replications. Application of FYM was carried out before ploughing in the last two seasons but not in the first season. Germinated seedlings in plots that received no FYM in the second and the third seasons ceased growth and behaved similarly to what happened in the first season. Therefore, extra seedlings of plots that received FYM were transplanted in plots that received no FYM during thinning. This was intended to study fodder transplanting on sandy soil with seedlings grown on a nursery that received FYM. Average chemical analysis of FYM applied in both seasons is presented in Table 2. Irrigation water was applied using sprinkler irrigation system. Each plot contained 4 ridges 5.2 m long and 50 cm apart with net area of 10.4 m^2. Seeds of the five varieties were sown in rows with 25 cm between hills at a rate of 7 kg/ha in all seasons. Germination percentage was determined 15 days after seeding. Seedlings were thinned to one seedling per hill 30 days after planting. Nitrogen and potassium fertilizers were added twice after thinning and one month after thinning at rates of 120 kg/ha of each of N and K in the forms of urea (46%) and K_2SO_4 (50%), respectively. In May random samples of 10 up-rooted plants from the guard rows were used to measure yield parameters, i.e., plant height, root length, root diameter, and dry matter percentage. The plants of all the experiments were up-rooted and fresh yield of each plot weighed and recorded as kg/plot and transformed into t/ha. Dry forage yield of each plot was determined too. The obtained data were statistically analyzed according to Steel and Torrie (1980).

RESULTS AND DISCUSSION

In the first season, 1993/94, germination percentage of all plots in the experiment was very low and germinated seedlings ceased to grow about one month after germination. Therefore, we did not get any data in that season. This result may be due to deficiency of essential nutrients and drought stress (Antoun *et al.*, 1989). Drought stress may be due to the very low water holding capacity of the sandy soil (Table 1). Average performance of fodder beet varieties as affected by FYM application levels based upon combined analysis of the last two seasons is presented in Table (3). The seasonal effect was highly significant. Differences among varieties averaged over seasons were significant for all the measured traits. Monovert cv. gave the highest yield (20.69 t/ha) while Magnum cv. gave the lowest yield (12.63 t/ha) under FYM application. However, the obtained fodder yield is relatively low in comparison with that obtained by Rammah *et al.* (1984) on highly fertile soil (more than 200 t/ha). Moreover, effects due to FYM levels and its interaction with varieties were significant for most of the studied traits. Application of FYM to the field led to an average fresh yield (15.24 t/ha) in comparison with 7.74 t/ha obtained as a result of applying FYM to nursery and transplanting in plots that received no FYM. A similar trend was detected for the rest of the studied traits. FYM application resulted in an increase of 145, 97, 55, 40, 39 and 43 for dry yield, fresh yield, germination percentage, plant height, root length and root diameter, respectively, as a percentage of yield of plots that had no FYM applied averaged over varieties and the last two seasons. FYM seemed to play a very crucial role which resulted in dramatic increase in fodder beet productivity on sandy soil. Fodder yield of cv. Monovert increased from 7.57 t/ha (no FMY applied) to 20.69 t/ha where FYM was applied (Table 3). This may be mainly due to an increase in the water holding capacity and improved availability of essential nutrients for plant growth in the sandy soil as a result of FYM application. Similar conclusions had been reached by Antoun *et al.* (1992) and Fathi *et al.* (1992). In their studies, plant and soil analyses revealed that application of organic matter led to an increase of nutrients in both plant parts and soil in comparison with no organic matter applied. It is quite clear from the results that growing fodder beet on sandy soil without applying FYM is impossible (first season result). However, applying FYM (plots received FYM) or transplanting seedlings in plots that received no FYM but started growing in a nursery that received FYM resulted in successful growth on sandy soil. Also it is clear from the results that plants that were seeded and continued their growth on plots that received FYM produced higher yield in comparison with transplanted plants on plots received no FYM. Whether applying FYM to the whole field or to a nursery and then transplanting to a field that received no FYM is economically

viable is still a question that needs to be answered. In conclusion, our results as well as previous results supported the fact that addition of organic matter can be an effective method to convert the non-productive sandy soil to a productive soil.

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Table 1
Experimental site soil properties.

$CaCO_3$		02.2
SP (w/w)		23.0
pH		07.9
EC.dS m^{-1}		02.2
Ca^{+2}	meq l^{-1}	04.4
Mg^{+2}	meq l^{-1}	02.8
Na^{+1}	meq l^{-1}	13.4
K^{+1}	meq l^{-1}	00.8
HCO_3^{-1}	meq l^{-1}	03.5
Cl^{-1}	meq l^{-1}	08.6
SO_4^{-2}	meq l^{-1}	07.3
$NaHCO_3^{-1}$ extractable P mg 100^{-1}		00.5
Sand %		86.0
Silt %		07.8
Clay %		06.2
Textural class		Loamy sand

Table 2
Chemical analysis of farm yard manure (FYM)

Moisture	OM	N	P	K	Fe	Zn	Mn
		%				ppm	
7.13	52.54	0.53	0.35	1.25	500	192	80

Table 3
Average performance of fodder beet varieties under applying FYM vs. none based upon combined analysis of two seasons.

Treatment	Variety*	Fresh yield t/ha	Dry yield t/ha	Plant height cm	Root length cm	Root Diameter cm	Germination %
No FYM applied	1	8.41 D	1.02 D	34.6 E	21.4 E	8.4 CD	49.3 BC
	2	5.95 E	0.74 E	36.6 E	20.6 EF	8.6 CD	39.5 D
	3	8.83 D	1.14 D	36.5 E	21.4 DE	9.7 C	44.5 CD
	4	7.57 DE	0.93 DE	34.5 E	17.9 F	8.1 D	44.0 CD
	5	7.64 DE	0.98 DE	39.6 D	24.8 C	8.6 CD	47.4 CD
72 m^3/ha FYM applied	1	13.38 C	1.95 C	51.4 B	28.6 B	11.3 B	71.6 A
	2	12.36 C	1.93 C	47.4 C	29.1 B	12.3 B	75.3 A
	3	20.69 A	3.21 A	57.5 A	34.9 A	14.4 A	68.3 A
	4	16.14 B	2.50 B	44.9 C	24.3 CD	11.8 B	57.4 B
	5	13.71 C	2.17 C	53.8 B	30.5 B	12.4 B	75.6 A

* cv. 1=Monofix, 2 = Magnum, 3 = Monovert, 4 = Beta Voroshenger, 5 = White Giant Green Top.
Varieties followed by different letters in the same column are significantly different at 5 % level.