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New Crops to Increase Diversity in Egyptian Cropping Systems

[1]E.M Abd El-Lateef, [2]A.A. Yaseen, [1]M.S. Abd El-Salam,
[1]A.K.M. Salem and [3]Aml R.M. Yousef

[1]Field Crops Research Dept., Agricultural Division,
National Research Centre, 33 El-Behooth St., Giza, Egypt
[2]Plant Nutrition Department, Agricultural Division,
National Research Centre, 33 El-Behooth St., Giza, Egypt
[3]Horticultural Crops Technology, National Research Centre, 33 El-Behooth St., Giza, Egypt

Abstract: In order to create and increase the diversity of crops used in the Egyptian agriculture a study of the historical neglected crop prickly oil lettuce and three alternative crop species, triticale, mungbean and fababean, was undertaken in Kena (upper Egypt). The results showed that prickly oil lettuce produces about 580 kg of seeds gives about 135 kg of oil ha^{-1} and could be used to increase diversity in the Egyptian ecosystems. Triticale and mung bean also performed well and could be incorporated as new crops to create and increase the diversity in cropping systems in Egypt in the future. Sustainable biodiversity could be achieved by maintaining local genetic resources (e.g. prickly oil lettuce) and preventing their extinction and introducing new crops in the Egyptian agriculture.

Key words: Biodiversity · Faba bean · Prickly oil lettuce · Mungbean · Triticale

INTRODUCTION

In Egypt, it was found that by the end of 2017, 364 species of the over 22, 000 species native to the region are in risk of extinction. Major efforts are needed to assess taxonomic groups or species status including crop genetic diversity. Agricultural biodiversity decreased due to intensification of systems of crop production. In the past 50 years new uniform crop varieties and hybrids have replaced many hundreds, if not thousands, of local varieties and landraces over large areas of production. These new varieties are selected from the same gene pool resulting in the increase of sensitivity to pests, diseases and the prevailing abiotic stressors. Some Egyptian farmers who still use the seeds of old local varieties in many rural areas. These are a very rich biodiversity source. Lettuce seed oil is such a crop that is still used to this day in Egypt for medicinal purposes, massage, cooking as alternative for olive oil or margarine. It contains lactucin which is analgesic and sedative and folic acid, which regulates digestion, strengthens the nervous system. It is also rich in the A, C, K and B vitamin group, beta-carotene, riboflavin, calcium, phosphorous, magnesium, iron and iodine. Abd El-Lateef and Abd El-Salam [1] also identify other sources candidates as new crops viz., grain legumes such as cowpea (*Vigna sinensis*), lupins (*Lupinus* spp.), mungbean (*Vigna radiata* L. Wilczek) and pigeonpea (*Cajanus cajan*). These legume are neglected in Egypt and can fit as double purpose crops to be incorporated in the Egyptian agriculture.

Therefore, there is a need to maintain the diversity of important local crops and further diversify other crop options to improve the the sustainability and productivity of the main crops used in the Egyptian agriculture.

MATERIALS AND METHODS

This work was carried out in order to create and increase the biodiversity of the crop species currently used in the Egyptian agriculture. The main ways this was explored was through:

Corresponding Author: Dr. E.M. Abd El-Lateef, Field Crops Research Dept., Agricultural Division, National Research Centre, 33 El-Behooth St., Giza, Egypt.

- Development and use of local neglected crops under local Egyptian conditions. There are some underused crops in Egypt like safflower, lupin and as an example the historical crop Prickly oil lettuce. A survey for prickly oil lettuce crop was undertaken in Kena (Upper Egypt) in scattered fields with local genetic source to identify the potentiality of this crop of seed and oil yields in the native origin.
- Introduction of new crops.

Field trials were conducted in different sites to evaluate introduction of some new genetic resources of three crop species suitable to Mediterranean basin climate. The evaluation included triticale (*Triticale hexaploide* Lart.), mungbean (*Vigna radiate* L. Wilczek) and determinate and indeterminate faba bean (*Vicia faba* L.) plant types.

RESULTS

Prickly Oil Lettuce Evaluation: The survey on prickly oil lettuce indicated that it is grown in Egypt on minor scale in scattered areas in Upper Egypt as a winter crop and harvested after 6 months. It produces about 580 kg of seeds and about 135 kg/ha of oil. The obtained results are supported by the results obtained by [2, 3] who reported that the oil content of prickly oil lettuce ranged from 39.8 to 41.4 %.

Triticale: Significant differences were found in forage and grain yields among triticale genotypes evaluated. Forage yield ranged between 1.8 and 6.0 t/ha. When the plants were left to produce grain after cutting for forage (i.e. dual-purpose use), grain yield ranged between 1.7 and 3.9 t/ha. These results showed that triticale proved to be a promising field crop with the potentiality of being with double purpose utilization in Egypt under Mediterranean climate [1].

Faba Bean: Determinate faba bean was compared with the indeterminate type (the common type in Egypt) under different cropping systems. Generally, the results showed that the indeterminate faba bean type plants surpassed the determinate plants in most agronomic measures, especially yield and yield components. The seed yield was 3.97 versus 2.82 t/ha for the indeterminate and determinate types, respectively. The study indicated that faba bean productivity was very sensitive to growth habit. Indeterminate faba bean types are considered to be more favored for the Egyptian agriculture more than the determinate faba bean ones for its greater yield. This shows the importance of choosing the proper plant type for developing diversity and cultural practices to increase yields under specific environments [4-9].

Mungbean: Mung bean was evaluated as a new introduced crop for seed or forage in arable lands and proved to be a short duration crop (70-90 days) and can be incorporated strongly in the Egyptian agriculture. Varietal differences among mungbean genotypes in seed yield and yield components were evident (Table 2). For forage experiment two seeding rates 96 and 144 $kgha^{-1}$ of Kawmy-1 seeds and cutting dates were 50, 70 and 90 days from sowing. fresh and dry weights of harvested forage were determined and a reasonable yield could be obtained.

The results are in harmony with the finding of Abd El-Lateef, [1].

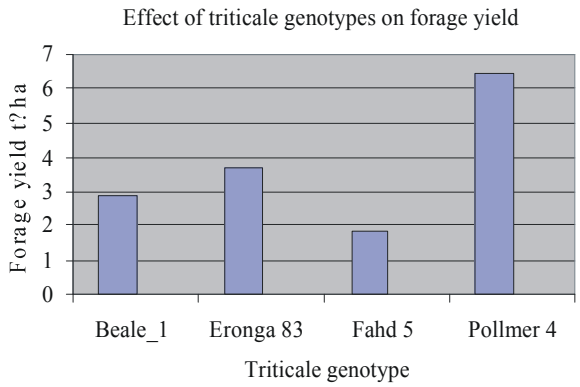

Fig. 1: Triticale productivity as forage crop

Table 1: Triticale productivity as cereal crop

Genotype	Grain yield (ton/ha)	Straw yield (ton/ha)	Biological yield (ton/ha)
Beale 1	1.92b	2.96b	4.14b
Eronga 83	1.37c	3.91ab	5.29ab
Fahd 5	3.90a	3.45ab	5.15ab
Pollmer4	1.88b	4.35a	6.23a
Probability	<0.001***	0.047*	0.003**
LSD (P=0.05)	0.28	1.33	1.26

Table 2: Effect of varietal differences on mungbean seed yield

Mungbean genotype	Seed yield (ton/ha)	Straw yield (ton/ha)	Biological yield (ton/ha)
Kawmy-1	3.112	9.70	12.816
V 2010	2.294	12.98	15.266
VC1000	2.278	12.34	16.56
VC 2719	2.268	12.52	14.79
M 53	2.520	10.02	12.54
T 44	1.57	2.83	14.46
LSD 0.05	0.472	0.828	1.488

Table 3: Effect of mungbean seed rate and differences on mungbean seed yield

Cutting Date	Seeding rate (kg/ha)	Forage yield (ton/ha)
50	96	48.0
	144	47.3
70	96	71.4
	144	92.7
90	96	57.4
	144	99.9

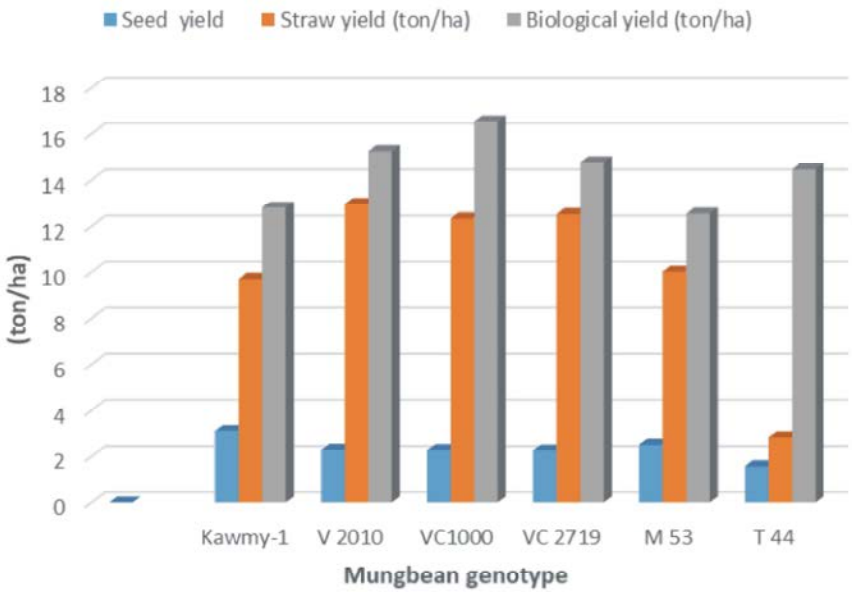

Fig. 2: Effect of varietal difference on mungbean seed yield

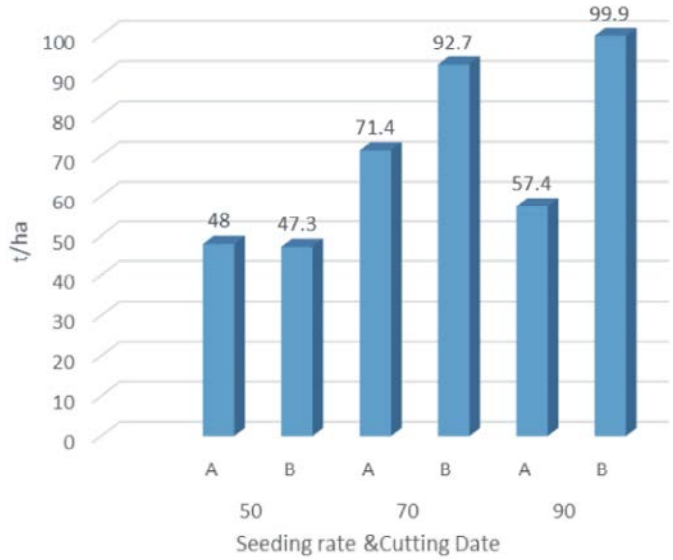

Fig. 3: Effect of mungbean seed rate and differences cutting dates on fresh forage yield (t/ha)
A =96 kg/ha, B = 144 kg /ha

CONCLUSION

Increasing biodiversity in the Egyptian ecosystems could be achieved by paying attention to the local genetic resources by preventing their extinction and improve the biodiversity in the Egyptian environment. Development and use of local neglected crops under local Egyptian conditions may increase bio diversity Introduction of grain legumes to the Egyptian agriculture may share in stabilizing agro-biodiversity. It can be concluded from this study that triticale and mungbean can be easily incorporated as double purpose utilization new crops to create and increase the biodiversity in the forthcoming decades in Egypt.

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