Possibility of Intercropping Maize and Berseem In The Nile Delta, Egypt

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Introduction

In Egypt, the agricultural land area of about 7.2 million feddan (1 feddan = 0.42 ha), accounts for only 3 percent of the total land area (El-Sherif, 1997). The entire cultivation area is irrigated, except for some rainfed areas on the Mediterranean coast. Egypt is located in arid climate zone with an annual average rainfall ranging from 60-190 mm in the Mediterranean sea coast area to 25-60mm in the Nile delta area, and less than 25 mm in upper Egypt. Food production in the Nile delta has supported Egyptian daily life for a long time (Hamdan, 2000). Egypt’s annual agricultural production growth rate was about 1.39 percent from 2007 to 2012 (FAO, 2015), while the population growth rate and annual population growth rates were 11.8% and 2.1-2.8% during the same period, respectively (UNICEF, 2014). Therefore, it was important to increase the agricultural production in the limited agricultural area under scarce water resources.

Maize (Zea mays L.) is one of the important crops in Egypt and the cultivated area increased from 700,000ha in 2012 to 750,000ha in 2013 (Hamza and Beillard, 2013). Maize cultivation aims at the production of at least 50 percent for livestock and poultry feed. Maize is commonly cultivated from May and harvested in August, although some farmers cultivate maize twice a year (Mansour, 2012). About 4.4Mt of maize was imported in 2012 since maize production in Egypt is not sufficient for human consumption, and is mainly used for forage and animal feed. The demand for corn oil and food products containing corn has increased, recently (Mansour, 2012), along with glucose and fructose production, as well as fresh consumption (Hamza and Beillard, 2013).

Egyptian clover, berseem (Trifolium alexandrinum L.) is the major winter forage crop cultivated in the Nile valley and delta. Berseem is cultivated on about 1.2 million feddans, while wheat on about 6 million feddans.

The objective of the present study was to promote an effective use of field by the intercropping of maize and berseem to the increase the agricultural yield (g m⁻²), while avoiding the decrease of maize production. Therefore, berseem was cultivated from September 2013 by seeding the open space between lines of growing maize.

Materials and Methods

Monoculture of maize and berseem along with intercropping of both plants was carried out in the experimental fields of the Agricultural Research Center (ARC) in Sakha, Kafr El-Shaikh, Egypt. Maize (cv. Yellow maize hybrid 352) seeds were sown at the rate of 2 seeds per hole, on the ridges on September 17, 2013. Line distance was about 70cm and plant distance was 25cm. After their emergence, the seedlings were thinned to one plant per hole. In intercropping plot, berseem (cv. El Helali) seeds were drilled on one side of the slope of ridges, while seeds were drilled on the top of ridges in the monoculture plots on October 13, 2013 (Fig. 1). Field soils were classified according to “Soil Taxonomy” as order Vertisols. An area of about 45m × 48m (2160 m²), was divided into 6 plots in the field, with treatment replication in 2 plots. In the monoculture fields, the sowing rate

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of berseem was 47.6 kg seeds ha⁻¹ and that of maize was 47.6 kg seeds ha⁻¹. In the intercropping fields, the rate of berseem was 23.8 kg seeds ha⁻¹, and that of maize was 47.6 kg seeds ha⁻¹. Fertilizers were applied as follows, Urea:714 kg ha⁻¹, CaPO₄:476 kg ha⁻¹, while no urea was applied in the berseem monoculture fields. Irrigation method consisting of conventional surface irrigation was started immediately before seeding. The interval of irrigation was 10–15 days. All the plants were harvested on January 28, 2014, then 3 maize and 10 berseem plants in each plot were selected for the determination of the plant length, fresh and dry weight of stem, leaves and ears of maize, fresh and dry weight of the above ground part of berseem in a 1 m² quadrat.

**Results and Discussion**

In Egypt, intercropping studies of maize and soy showed that the leaf area and yield/plant of intercropped maize were higher than that in monocultures (Metwally et al., 2009a). Intercropping of maize with cotton, revealed that, the values of the leaf area, plant dry weight and yield/plant of intercropped maize were higher than that of monocropped maize at the same density on the ridges (Metwally et al., 2009b). In the present study, the values of the plant length, fresh weight and dry weight of stem, leaves and ears of intercropped maize tended to be higher than those of monocultured maize (Table 1). Fresh weight and dry weight of above ground part of intercropped berseem tended to be significantly lower than those of monocultured berseem, while the value of plant length of intercropped berseem was higher. In intercropped fields, maize plants had shaded lower plants, resulting in the inhibition of the growth of berseem (Fig. 2 and Table 1). Under these conditions, the plants of berseem, a leguminous crop, became adapted to a low light environment and they developed vine. LER value based on the dry weight of the plants (Willey, 1979) was 1.12 in the intercropping. Allen and Obura (1983) recorded in a maize-cowpea intercropping LER

![Image](image_url)

**Fig. 1.** Cropping patterns in monoculture and intercropping of maize and berseem. M: maize, B: berseem.

![Image](image_url)

**Fig. 2.** Berseem growth under shading of maize.

<table>
<thead>
<tr>
<th>Crops</th>
<th>Plant length (cm)</th>
<th>Stem</th>
<th>Leaves</th>
<th>Ears</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fresh wt. (g m⁻²)</td>
<td>Dry wt. (g m⁻²)</td>
<td>Fresh wt. (g m⁻²)</td>
<td>Dry wt. (g m⁻²)</td>
</tr>
<tr>
<td>Maize</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>monoculture</td>
<td>264.8 ± 11.8*</td>
<td>596.7 ± 10.0</td>
<td>131.2 ± 1.4</td>
<td>150.0 ± 13.3</td>
</tr>
<tr>
<td>intercropping</td>
<td>289.2 ± 17.5</td>
<td>591.7 ± 21.7</td>
<td>144.1 ± 5.9</td>
<td>186.7 ± 0.0</td>
</tr>
<tr>
<td>Berseem</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>monoculture</td>
<td>68.6 ± 1.3</td>
<td>1950.0 ± 117</td>
<td>234.9 ± 24.0</td>
<td></td>
</tr>
<tr>
<td>intercropping</td>
<td>71.3 ± 0.5</td>
<td>125.0 ± 25.0</td>
<td>10.8 ± 6.7</td>
<td></td>
</tr>
</tbody>
</table>

*Means ±S.D.
values up to 1.27 in 1980 and 1.32 in 1981. Mohta and De (1980) observed that the LER values increased to about 48% and 31% in the intercropping of maize and sorghum with soy compared with monoculture, respectively. Although the LER value was not very high in the present study, intercropped maize tended to show higher values for all the growth parameters than in the monoculture. Agboola and Fayemi (1971) cultivated maize and nine different tropical legumes as an intercropping. The results showed that the intercropping did not affect the yield of maize.

Intercropped berseem plants that were additionally produced became a source of income for the farmers in the present study, because berseem had been cultivated in the open space between maize lines. On the other hand, the vegetation covering the plants inhibited evaporation from the soil surface and berseem could use effectively the soil water for growth. It is considered this type of intercropping in the Nile delta agricultural fields contributed to the increase of agricultural production.

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References