Effects of Arbuscular Mycorrhizal Fungi on Growth and Yield of Baby Corn (*Zea mays* Linn.) in Skeletal Soils Under Non-Sterilized Soil

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ABSTRACT

Effects of Arbuscular mycorrhizal fungi (AMF) on baby corn growth was studied to observe how AMF promoting baby corn. The experiment was set at Faculty of Agriculture Technology, Buriram Rajabhat University. The CRD was designed for this experiment with 5 treatments namely 1) no AMF inoculation 2) inoculated with *Glomus* sp 2 3) inoculated with *Glomus* sp 3 4) inoculated with *Glomus mosseae* and 5) recommended rate of chemical fertilizer using 15-15-15 and 46-0-0. ANOVA and mean comparison using DMRT was analyzed for height, number of leaf, yield, fresh weight and dry weight using DMRT SPSS v 11. AMF colonization was also examined in baby corn root after harvesting. AMF application showed no significantly ($p>0.05$) increase of baby corn height, number of leaf, fresh weight and dry weight while chemical fertilizer application showed highly significant ($p<0.01$) increase growth of baby corn. *Glomus mosseae* showed trend to increase baby corn growth more than *Glomus* sp 3 and *Glomus* sp 2 while *Glomus* sp 2 showed trend to increase baby corn yield more than other. However all of AMF, *Glomus* sp 2, and *Glomus* sp 3, showed low colonization (1-5%) in baby corn root under skeletal soil natural condition. The result showed that AMF should not be used as biofertilizer to promote baby corn growth in skeletal soil under natural condition.

Keywords : AMF, Maize, Baby corn, Skeleton soils

INTRODUCTION

Baby corn is a cereal grain taken from corn (maize) harvested early while the ears are very small and immature. It typically is eaten whole–cob included—in contrast to mature corn, whose cob is considered too tough for human consumption. Baby corn is eaten both raw and cooked. Baby corn is most common in Asian cuisine [1]. Eighty percent of the total land area in Thailand is classified as having soils of low fertility. Either application of inorganic or organic fertilizer is needed to improve crop production in agricultural systems. AMF can colonize maize roots and promote crop yield by developing early in the crop cycle of maize [2] and showed colonization about 60-80% [3]. Also, the AMF have other potential benefits for example, AMF assisted maize to sustain moderate drought stress and to recover rapidly when irrigation was restored [4]. To date, research in Thailand has concentrated on the ultilization of AMF to promote the yield of many crops, such as, strawberry [5], peanut [6] and citrus [7]. AMF have also been used to establish seedlings of forest trees, citrus seedlings [8] and native tree seedlings [9]. The AMF species effects on growth and nutrient uptake of sunflower [10]. Skeletal soils are those having substantial amount of coarse materials present within 50 centimeters from the soil surface [11]. They were considered problem soils in Thailand [12]. AMF promote plant growth and nutrient uptake in soils of low fertility [13] [14]. AMF can influence plant growth traits [15] and improve plant nutrition [16]. The research investigated the effect of AMF on growth and yield of baby corn planting in skeleton soil under non sterilized soil for to examine the efficiency of AMF species in promoting growth of baby corn under skeleton soil with natural condition.

METHODS

The study of effects of Arbuscular mycorrhizal fungi (AMF) on baby corn growth was using CRD with five treatments and four replications namely (1) no inoculation (2) inoculated with *Glomus* sp.2 (3) inoculated with *Glomus* sp.3 (4) inoculated with *Glomus mosseae* (5) recommended rates of 15 – 15 – 15 and 46 - 0 – 0 fertilizer. Five hundreds kilograms of skeleton soil were taken from a farmer field, air dried and well mixed. Then twenty kilograms of the soil were filled in each pot (30 cm in diameters and 45 cm in height). The commercial baby corn variety was done seeding. The soil inoculum was placed on the surface of the soil in each pot and seeds were then placed on top and covered with 1-cm layer of soil. Tap water was added daily to the soil surface to keep the soil at field capacity throughout the cropping period. Plants were thinned to 1 plant per pot at 14 days after planting. Plants were grown in outdoor during December 2009 to March 2010 under natural conditions. At harvesting stage, the plants were cut at the soil surface and the soil was left to dry out in the pot. After air drying, the pot soil was crushed and well mixed by hand. Maize roots were removed from soil as much as possible, and washed by tap water until clean and brought to the laboratory for root colonization by AMF. Data collection were 1) shoot height at 36, 43, 49, 56, 63 and 71 (harvested stage) days after planting 2) number of leaves at 36, 43, 49, 56, 63 and 71 (harvested stage) days after planting 3) yield of baby corn 4) fresh weight 5) dry weight and 6) % root colonization was determined by the Trouvelet 's method [17]. ANOVA and mean comparison using DMRT was analyzed for height, number of leaf, yield, fresh weight and dry weight using DMRT SPSS v 11.

RESULTS AND DISCUSSION

There was no effect ($p>0.05$) of AMF inoculation on baby corn growth and yield compared with no inoculation and fertilizers application (Table 1 – 3). However application of chemical fertilizer 15 – 15 – 15 and 46-0–0 recommended rates showed higher growth and yield than AMF inoculation as shown in Table 1-3. In this study *Glomus* sp.3 showed a tendency of promote growth and yield of baby corn more than *Glomus* sp.2 and *Glomus mosseae*. As we know that AMF can help increase the effectiveness of fertilizer P added to soils that are P-deficient or having high P-fixing capacity. For example, in an acidic soil, addition of AMF and rock phosphate (RP) fertilizer together were more effective in enhancing the growth of corn than when RP was added alone [18]. Inoculating soybean with *Glomus manihotis* significantly increased dry matter yield, and N and P uptake in an acidic Latosol in Indonesia [19]. As well as increased growth, AMF colonization increased pollen quantity and quality of tomato, thereby enhancing male reproductive fitness, probably due to improved P acquisition [20]. However, AMF colonization in baby corn under non-sterilized skeleton soil was very low about 1-5%. These might be a reason for low growth and yield of baby corn in this study.

Table 1 Height of baby corn as affected by different treatments and sampling dates

Treatment	Height of baby corn (cm)					
	36 DAP	43 DAP	49 DAP	56 DAP	63 DAP	71 DAP
1) No inoculation	15.9	21.0	27.5	34.2	47.2	72.2
2) Inoculated with *Glomus* sp.2	16.1	23.0	29.5	39.0	57.2	76.0
3) Inoculated with *Glomus* sp.3	15.5	28.2	36.2	46.0	62.0	91.5
4) Inoculated with *Glomus mosseae*	15.0	26.5	37.5	52.5	64.7	84.0
5) Recommended commercial fertilizer	13.7	26.0	42.5	57.7	93.5	120
F-test	ns	ns	ns	ns	ns	ns
CV(%)	31.9	25.7	24.1	24.4	30.2	27.3

In a column, means followed by a different letter are significantly different by $DMRT_{0.05}$

Table 2 Leaf number of baby corn as affected by different treatments and sampling dates

Treatment	Leaf number of baby corn					
	36 DAP	43 DAP	49 DAP	56 DAP	63 DAP	71 DAP
1) No inoculation	9.25	9.50	10.0	12.00	14.50	15.25
2) Inoculated with *Glomus* sp.2	9.00	9.50	11.25	12.75	15.25	15.75
3) Inoculated with *Glomus* sp.3	9.00	9.25	11.25	12.75	15.50	16.50
4) Inoculated with *Glomus mosseae*	9.25	10.00	12.25	13.50	15.00	15.75
5) Recommended commercial fertilizer	8.25	10.75	12.75	14.25	16.75	16.50
F-test	ns	ns	ns	ns	ns	ns
CV (%)	7.14	12.3	10.9	10.7	10.0	8.3

In a column, means followed by a different letter are significantly different by $DMRT_{0.05}$

Table 3 Baby corn yield (g pot^{-1}), fresh weight (g pot^{-1}), dry weight (g pot^{-1}) and AMF colonization found in baby corn root

Treatment	Yield (g pot^{-1})	Fresh weight (g pot^{-1})	Dry weight (g pot^{-1})	AMF colonization in baby corn root (%)
1) No inoculation	1.55	58.7^{b}	23.4^{b}	x
2) Inoculated with *Glomus* sp.2	1.30	67.5^{b}	30.4^{b}	/
3) Inoculated with *Glomus* sp.3	2.00	92.5^{b}	46.9^{b}	/
4) Inoculated with *Glomus mosseae*	1.75	92.5^{b}	41.1^{b}	/
5) Recommended commercial fertilizer	9.00	301.25^{a}	103.9^{a}	x
F-test	ns	*	*	
CV (%)	41.0	27.8	42.9	

In a column, means followed by a different letter are significantly different by $DMRT_{0.05}$

× no AMF colonization found / AMF colonization found

CONCLUSION

AMF, *Glomus* sp. 2, *Glomus mossea* and *Glomus* sp. 3 could colonize and promote growth and yield of baby corn under skeletal soil in natural condition. However, low colonization (1-5%) in baby corn root and less promote growth and yield than using 15-15-15 and 46-0-0 fertilizer. And Baby corn inoculated with *Glomus mossea* showed more growth and yield than others except for applied with 15-15-15 and 46-0-0. The result showed that AMF should not be used as biofertilizer to promote baby corn growth in skeletal soil under natural condition.

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