

Enhanced Growth of Arbuscular Mycorrhizal Fungus-inoculated Celery Seedlings Transplanted to a Field

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Celery (*Apium graveolens* L Cornell no. 619) seedlings inoculated with arbuscular mycorrhizal (AM) fungus [*Glomus etunicatum* Becker and Gerdemann (GE), *Glomus intraradices* Schenck and Smith (GI), and *Gigaspora margarita* Becker and Hall (GM)] were transplanted to a field in order to test the promotive effect of AM fungus infection on the growth of celery.

Arbuscular mycorrhizal fungus-inoculated plants growing in a greenhouse for 8 weeks were superior to non-inoculated plants in height, leaf (blade and petiole), and root dry weights in each fungus species. The AM fungus infection level of the root systems differed among AM fungus species (Table 1).

Table 1. Effect of arbuscular mycorrhizal (AM) fungus inoculation on greenhouse growth of celery (Cornell no. 619) seedlings^z.

AM fungus inoculation ^y	Plant height (cm)	No. of leaves	Dry weight of leaves (g)	Dry weight of roots (g)	RFIPR ^x (%)
None	12.5 a ^w	8.0 a	1.52 a	0.41 a	0
<i>Glomus etunicatum</i>	17.0 bc	9.3 a	2.08 c	0.93 c	30.4 b
<i>G. intraradices</i>	15.3 b	9.0 a	1.87 b	0.66 b	24.0 a
<i>Gigaspora margarita</i>	18.3 c	8.9 a	1.89 b	0.70 b	37.2 c

^zData were obtained from 10 plants at 8 weeks after inoculation.

^yNone, non-inoculated; *G. etunicatum* and *G. intraradices*, inoculated at 1000 spores g⁻¹ inoculum; *G. margarita*, inoculated at 100 spores g⁻¹ inoculum.

^xRate of AM fungus-infected portions in a whole root system (evaluated by the gridline intersection method).

^wMean separation within Columns by Duncan's multiple range test, 5% level.

After 10 weeks of field growth (at harvest time), GE- or GM-inoculated plants gave greater values in plant height, number of leaves, maximum length of leaves, length of first internode, and fresh weight of leaves. GI-inoculated and non-inoculated plants gave similar values on the items listed above. The AM fungus infection level in a whole root system rose higher in both GE- or GM-inoculated plants than in GI-inoculated ones (Table 2).

Table 2. Effect of arbuscular mycorrhizal (AM) fungus inoculation on field growth of celery (Cornell no. 619) plants^z.

AM Fungus inoculation ^y	Plant height (cm)	No. of leaves	Length of largest leaves (cm)	Length of 1st internode (cm)	Fresh weight of leaves (g)	RFIPR ^x (%)
None	52.0 a ^w	13.3 a	49.8 a	20.0 a	586.7 a	5.7 a
<i>Glomus etunicatum</i>	60.8 b	16.6 b	55.8 b	26.3 c	915.7 c	35.6 c
<i>G. intraradices</i>	53.4 a	13.4 a	50.5 a	20.4 a	602.9 ab	30.1 b
<i>Gigaspora margarita</i>	59.6 b	15.5 b	54.7 b	23.5 b	736.8 b	40.2 c

^zData were expressed on the basis of 10 plants 10 weeks after transplanting^yNone, non-inoculated; *G. etunicatum* and *G. intraradices*, inoculated at 1000 spores g⁻¹ inoculum; *G. margarita*, inoculated at 100 spores g⁻¹ inoculum.^xRate of AM fungus-infected portions in a whole root system (evaluated by the gridline intersection method).^wMean separation Within Columns by Duncan's multiple range test, 5% level.

The analysis of mineral nutrients (N, P, K, Ca, and Mg), in the harvested leaves of celery showed only a little difference among the treatments in concentrations of the mineral nutrients (Table 3).

It was clear that growth enhancement through symbiosis occurred in AM fungus-inoculated field-grown celery seedlings.

Table 3. Effect of arbuscular mycorrhizal (AM) fungus inoculation on mineral nutrient concentrations in harvested leaves of celery (Cornell no. 619)^z.

AM fungus inoculation ^y	Mineral nutrient concentration in leaves (% D.W.)				
	N	P	K	Ca	Mg
None	3.15 a ^x	0.40 a	4.42 a	1.25 a	0.34 a
<i>Glomus etunicatum</i>	2.99 b	0.35 a	4.74 c	1.24 a	0.29 b
<i>G. intraradices</i>	3.04 b	0.39 a	4.39 a	1.28 a	0.36 a
<i>Gigaspora margarita</i>	3.11 a	0.38 a	4.56 b	1.56 b	0.28 b

^zData were expressed on the basis of 10 plants 10 weeks after transplanting

^yNone, non-inoculated; *G. etunicatum* and *G. intraradices*, inoculated at 1000 spores g⁻¹ inoculum; *G. margarita*, inoculated at 100 spores g⁻¹ inoculum.

^wMean separation Within Columns by Duncan's multiple range test, 5% level.