Medicago species Root Race: *M. truncatula* wins over *M. arborea, lupulina,* and *sativa*

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One goal was to determine which species grew to the bottom of drainage tiles, 30 cm. in length in the greenhouse. Another goal was to observe the morphology of the roots of the various species when growth was relatively unrestricted. Scarified seed was planted on the same day in Jiffy-7 pellets to avoid any disease problems, and pellets with uniformly emerged seedlings were transferred to tiles two days after cotyledons opened.

Tiles were filled with Metro-Mix 300 (vermiculite, peat moss, pearlite, and composted pine bark).
The tiles held four pellets/seedlings each, and there were two tiles for each species. The size of the experiment was limited by the availability of tiles. Natural light in the greenhouse was supplemented with mercury vapor lamps set for a 16 hour day length. Tiles positions were shifted every three days to equalize position effects.

Roots of *M. truncatula* cv. Jemalong reached the bottom of both tiles after 26 days, thus growing a little more than one centimeter per day. Next came a New Mexico Plant Introduction provided by Ian Ray, that reached the bottom after 28 days. At 30 days all the other entries reached the bottom except *M. lupulina*, that took 32 days. The others included *M. arborea* (from the population reported in Vol. 5 of this web site), *M. sativa* cv. Pioneer 5454, Wilson (from New Mexico), and a derivative of *M. arborea* X *M. sativa*.

M. lupulina flowered one month after planting, *M. truncatula* flowered after five weeks, all of the *M. sativa* entries took six weeks, the *M. sativa-arborea* derivative required seven and a half weeks, and the *M. arborea* did not flower before the study was terminated at eight weeks.

Root growth of *M. truncatula* cv. Jemalong was impressive, as was the top growth. The top growth of Jemalong and 5454 was harvested, dried, and weighed at the time Jemalong was beginning to set pods, and 5454 was beginning to flower. Jemalong produced the most herbage, but rather than concluding anything from this small greenhouse study with only two replications (two tiles), we recommend the conclusions from a field study at the University of Minnesota involving *M. truncatula*, several other annual medics, and alfalfa. Single harvest yields of spring seeded, and summer seeded materials were highest for *M. truncatula* and most other annual medics than for alfalfa and red clover. See: Agronomy Journal 88:955-960 (1996).

Crowns and roots of two entries obtained from Ian Ray at New Mexico State University. Picture was taken two days after the roots reached the bottom of the tiles. Cultivar 'Wilson' seedlings were relatively uniform. The PI from New Mexico was less uniform, but had the fastest growing roots among the *M. sativa* entries. Perhaps the first roots to reach the bottom were from robust seedlings like the one on the right.

Cultivar 'Wilson' is used to compare with *M. lupulina*. *M. lupulina* was the smallest entry in root and shoot growth, but flowered earlier than the other *Medicago* species in the experiment.

This picture illustrates the tiles that were 30cm in length, with *M. lupulina* (left), *M. sativa* (center), and *M. truncatula* (right). The amount of herbage seen in the picture for each species was reflected in the weight of the herbage, but see the yield data in an excellent field study (Agronomy Journal 88:955-960, 1996).

Roots and crowns of *M. truncatula* (left), and *M. sativa* (right) alfalfa cultivar Pioneer 5454. The roots of *M. truncatula* look different in the picture from those of *M. sativa*, but if roots of the two species were mixed and unlabeled it would be difficult to tell them apart.