Development of the oil sands has led to increasing atmospheric N deposition, with values as high as 17 kg N ha-1 yr-1; regional background levels <2 kg N ha-1 yr-1. To examine responses to N deposition, over five years, we experimentally applied N (as NH4NO3) to a poor fen near Mariana Lake, Alberta, at rates of 0, 5, 10, 15, 20, and 25 kg N ha-1 yr-1, plus controls (no water or N addition). From 2014-2015, we examined the effects of N addition on root production by measuring root biomass at two depths and root production over one and two years. Root biomass, measured in 2014, increased with increasing N addition in the 0-15 and 15-30 cm depth increments. Root production increased with increasing N addition in the 0-15 cm, but not the 15-30 cm depth increment; annual root production in the 0-15 cm depth increment was higher when ingrowth bags remained in the peat for two growing seasons, compared to first-year root production. As a result, over the top 30 cm, annual root production was greater when ingrowth bags were in the peat for two growing seasons. We expected a threshold N addition level associated with stimulation of root production but found no evidence of such a threshold at Mariana Lake Poor Fen. Given the rather consistent finding increasing N deposition stimulates aboveground vascular plant biomass and production, and our results that root biomass and production at Mariana Lakes Bog are stimulated as well, further work on belowground responses seems warranted.