

Nitrogen Management Improves Organic Asparagus Growth and Productivity

D. Drost and K. Pedersen
Department of Plants, Soils, and Climate;
Utah State University; Logan, UT 84322-4820



Abstract

We assessed the influence of increasing nitrogen levels (50, 100, 150, 200 kg N/ha) on asparagus biomass (fern/root) and spear yield/quality. Nitrogen was applied after harvest beginning in 2014. Later each year, fern growth was assessed. Roots were sampled before the initial nitrogen application (2014) and again near the end of the study (2017). Increasing N up to 200 kg N/ha had no effect on fern growth but did significantly increase root biomass. Spear yield in the 50 kg N/ha treatment was significantly less than 100, 150 or 200 kg N/ha treatments, during the 3 harvest years. Analysis of root tissue showed a significant build up in N reserves as root biomass increased in response to increasing N applications. Findings indicate that over time, asparagus root growth and associated N storage helps increase productivity. Asparagus does not respond to excessively high N levels and additions of greater than 100 kg N/ha are unnecessary and unsustainable.

Objectives:

Evaluate the effects of organic nitrogen additions on asparagus growth and productivity.

Materials & Methods:

6-year-old certified organic asparagus field (originally weed management study; 2008-1012).

Field converted from weed control to N study in 2013.

Variety: Jersey Giant (crowns planted in 2007), plots 6.1 m long (2 rows per plot), 1.5 m row spacing, 5 replications. Soil tilled (2-3 cm) before harvest to control overwintering weeds with a second tillage operation after harvest.

A single application of feather meal (13% N) at 50, 100, 150, or 200 kg N/ha applied overtop of rows after harvest (mid-June: 2014-17).

The crop irrigated every 3 weeks from 1 June to 10 September. Between rows mowed in July to suppress weeds.

Fern number, fern height, and spear yield used to assess plant performance.

Soil cores (7.6 x 90 cm; 0, 30, 60 cm from row) collected (early April) to determine root biomass, distribution, and carbohydrate content. Soil and plant nitrogen evaluated in August.

Results & Discussion:

Yearly applications of increasing rates of organic N had no effect on seasonal fern height or fern number (Table 1). Fern height varied slightly from year-to-year which was partially related to seasonal environmental conditions. Fern number per meter of row increased from 2014 to 2015 (1st year of supplemental N) suggesting increasing crown growth. No difference was noted in later years.

90% of the asparagus root mass was in the upper 45 cm of the soil in 2014 prior to 1st N application (Table 2). By 2017, after 3 years of N applications, there were significantly more roots in the 0-15 cm depth suggesting new root growth. Total root weight across all N treatments increased by 14% from 49,990 kg/ha in 2014 to 56,974 kg/ha in 2017.

Organic N applications had no effect on storage root carbohydrate (range 450-500 mg/g DW) or N concentrations (range 3.8-4.3%) in any year.

Storage root growth was greatest when N was applied at 150 and 200 kg/ha (data not shown) where root biomass increased by more than 38%. Increase root growth would increase total CHO content and N storage which should positively impact spear productivity.

Total, large, and medium spear yield (2015-2017) responded in a positive linear fashion to increases in applied N (Fig. 1). Nitrogen rate did not always influence small/cull spear yield.

Applications of 100 kg N/ha of feather meal was adequate for high productivity as total yield was not different from higher N application rates.

Preliminary Conclusions:

Supplemental N may not increase fern growth or tissue N concentration but did increase asparagus root development. By increasing root biomass, asparagus can store more CHO's and N which contributes to higher spear yields. Findings suggest that 100-150 kg N/ha are adequate to achieve high yields of quality spears. More work is needed to determine the duration of organic nitrogen additions to maintain sustainable production for asparagus.

Table 1: Influence of N on fern height and number (2014-16).

N (kg/ha)	2014	2015	2016	2014	2015	2016
	Fern Height (m)			Fern (#/m)		
50	1.83	1.62	1.69	12.9	15.5	15.6
100	1.83	1.55	1.68	11.4	14.3	15.6
150	1.80	1.54	1.64	11.6	17.0	16.3
200	1.88	1.53	1.67	13.7	16.1	16.1
sign	ns	ns	ns	ns	ns	ns

Table 2: Fleshy storage root distribution by depth & distance for all N rates (2014 & 2017) plus total fresh weight (kg/ha).

Depth (cm)	2014 (pre-N)			2017		
	Distance from Row (cm)			Distance from Row (cm)		
	0	30	60	0	30	60
0-15	13%	5%	5%	24%	9%	5%
15-30	23%	14%	12%	23%	14%	7%
30-45	7%	7%	6%	4%	6%	5%
45-60	2%	2%	2%	1%	2%	1%
60-90	0%	1%	1%	0%	0%	0%
	Fresh Wt. (49,990 kg/ha)			Fresh Wt. (56,974 kg/ha)		

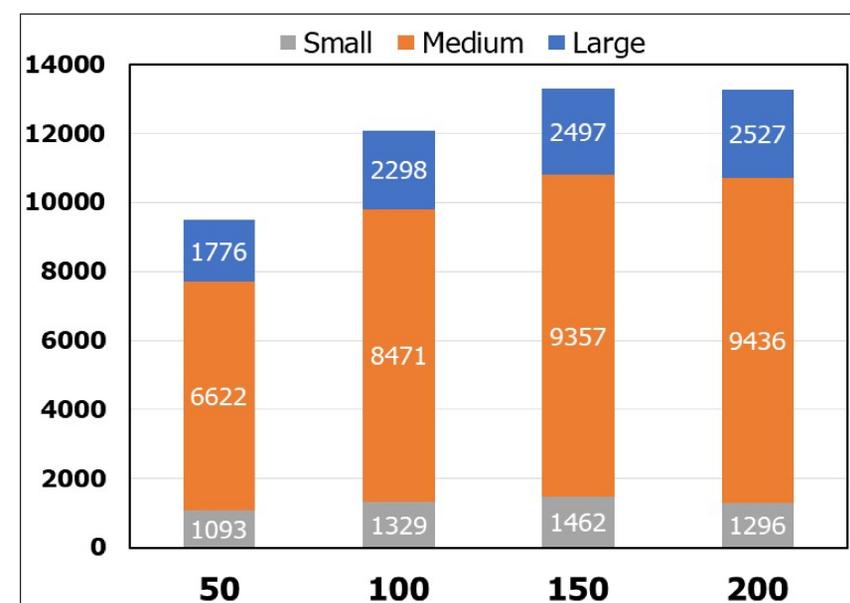


Fig. 1: The influence of N applications on total marketable spear yield (kg/ha) by grade class (summed for 2015-2017).