Legumes Alone and in Combination with Manure as Fertilizers in an Intensive Muskmelon Production System

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Before the advent of inorganic fertilizers, vegetable producers routinely used considerable amounts of livestock manures, soil-improving legumes in rotation with vegetables and other agronomic crops, and green manures in their farming operations (Kelly, 1990). The development of specialized farming operations in the Central Plain states has resulted in large commercial feed lots that produce an abundance of manure. If not used or stored properly this manure can pollute groundwater and cause other detrimental environmental consequences.

Pollution of groundwater, lakes, and streams by nitrates and phosphorus from inorganic fertilizers has been well documented (Porter, 1975). These problems have contributed to a renewed interest in crop production systems that use organic sources of fertilizers. We, therefore, determined the feasibility of producing netted muskmelons (*Cucumis melo* L.) using over-wintering legumes or winter wheat alone and in combination with animal manures while incorporating positive aspects of drip irrigation and plastic mulches (Lay and Wells, 1975; Schales and Sheldrake, 1965; Shmueli and Goldberg, 1971; Waggoner et al., 1960).

The experiment design was a split plot with main plots of legumes [alfalfa (*Medicago sativa* L. cv. Kansas Common), hairy vetch (*Vicia villosa* Roth), and Austrian winter pea (*Pisum sativum* subsp. *arvense* L. Poir)] and winter wheat (*Triticum aestivum* L. cv. Tam 107) seeded at 33, 33, 72, and 44 kg·ha⁻¹, respectively, 22 Sept. 1989 on a Hayne fine

sandy loam soil. On 3 May 1990, feed lot cow manure was applied to half of each main plot at 10 t·ha⁻¹. The field had been in soybeans during the summer before beginning the experiment. The soil was plowed, disked, and prepared for bedding before application of the plastic mulch and drip irrigation tubing. Control plots received no treatment or a complete fertilizer at 70, 100, and 135 kg N, P, and K/ha before bedding the soil. On 28 May 1990, 31-μm-thick, 1.2-m-wide, black, embossed mulch film and drip irrigation tape (0.20 mm thick, emission spacing 30 cm, flow rate of 1.5 liters·min⁻¹·30 m⁻¹ of row at 55 kPa) (Roberts Irrigation Products, San Marcos, Calif.) were applied using standard commercial practices. Each main plot consisted of three plastic-covered, 22-m-long rows on 1.5-m centers. 'Magnum.45' muskmelon transplants were grown in 24-cm³ cells for 4 weeks in a greenhouse and transplanted 45 cm apart on 31 May 1990. Soil water status was measured with tensiometers at 15- and 30-cm depths, and water

was applied when the soil water potential at 15 cm reached -0.25 kPa.

Melons were harvested 15 times, beginning on 27 July and ending on 31 Aug. 1990. Weight and number of marketable fruit were recorded.

The addition of cow manure increased the total weight of melons per hectare over the legumes or winter wheat alone (Table 1). The highest yield (nearly 97 t·ha⁻¹) was obtained from alfalfa + manure, which was similar to that from the highest rate of synthetic fertilizer. Total weight of melons increased as the amount of synthetic fertilizer increased to 135 kg N/ha, similar to findings of Bhella and Wilcox (1986) and W.J.L. et al. (unpublished data). There were some statistical differences in the fruit weight, but these were not of practical significance. Yields obtained with the legumes alone (Table 1), although lower than those with legumes plus manure, still were commercially satisfactory. Biomass production for alfalfa, hairy vetch, Austrian winter pea, and wheat on a dry-weight basis was 2800, 5600, 3200, and 4900 kg·ha⁻¹, respectively. They all provided excellent ground cover by 3 May and were winter hardy. The N content was 3.8%, 4.1%, 3.3%, and 1.6%, respectively. Problems associated with using manure for production of vegetables, as described by Kelly, 1990), may offset the improved yields. The advantage of using fall-planted and overwintered legumes for an annual crop may appeal to many vegetable growers who find the more traditional 3- to 4-year rotation with legumes unacceptable. The use of legumes coupled with drip irrigation and plastic mulches may offer a new cropping system that can produce high yields and protect the environment.

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Table 1. Influence of fertilizer source on 'Magnum.45' muskmelon yields.

Source	Fruit yield		Mean fruit wt (kg)
	(no./ha, thousands)	(t·ha ⁻¹)	
Organic			
Alfalfa	55.2	85.2	1.40
Alfalfa + manure	59.8	96.8	1.47
Hairy vetch	50.4	72.2	1.30
Hairy vetch + manure	58.4	92.0	1.43
Austrian winter pea	54.0	79.2	1.33
Austrian winter pea + manure	54.6	83.1	1.38
Wheat	51.8	77.1	1.35
Wheat + manure	54.8	85.2	1.41
Synthetic			
N (kg·ha ⁻¹)			
0	48.4	67.2	1.26
70	52.4	78.6	1.36
100	58.6	88.5	1.37
135	59.6	94.6	1.44
LSD 0.05	NS	7.39	0.08

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