SHORT COMMUNICATION

Effects of several organic fertilizers on growth of greenhouse tomato transplants

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Gagnon, B. and Berrouard, S. 1994. **Effects of several organic fertilizers on growth of greenhouse tomato transplants.** Can. J. Plant Sci. **74**: 167–168. An experiment was conducted to evaluate the potential of different organic wastes from the agri-food industry for growing greenhouse tomato (*Lycopersicon esculentum* Mill. 'Vision') transplants. The organic materials were thoroughly mixed with a peat-compost growing medium prior to transplanting. Meal from blood, feathers, meat, crab shells, fish, cottonseed and whey by-products produced the best growth, significantly increasing the shoot dry weight by 57–83% compared with non-fertilized plants.

Key words: *Lycopersicon esculentum*, organic fertilizer, peat, tomato, mineralization, nitrogen

Gagnon, B. et Berrouard, S. 1994. **Effets de différents engrais organiques sur la croissance de transplants de tomate de serre.** Can. J. Plant Sci. **74**: 167–168. Une expérience a été réalisée afin d'évaluer le potentiel de plusieurs sous-produits organiques provenant du secteur agro-alimentaire pour la préparation de transplants de tomate de serre (*Lycopersicon esculentum* Mill. 'Vision'). Les différents matériaux organiques ont été mélangés à un substrat de culture composé de tourbe et compost, avant le repiquage des plants. Les farines de sang, de plume, de viande, de crabe et de poisson, le tourteau de graines de coton et le petit-lait séché ont procuré la meilleure croissance, produisant des augmentations significatives de masse sèche des plants de 57 à 83% par rapport aux plants n'ayant reçu aucun fertilisant.

Mots clés: *Lycopersicon esculentum*, engrais organique, tourbe, tomate, minéralisation, azote

Production of organically grown vegetables has become increasingly popular. In such a system, plant nutrients are supplied at first by green manure, farmyard manure and compost, and then by regular applications of natural fertilizers (OCIPB 1992). These fertilizers, primarily processed wastes from the agri-food industry, may readily release their nutrients into the soil. Although these by-products have been largely valued as feed supplements for many years (Kelly 1990), several studies have reported the beneficial effects of blood meal, feather meal and cheese whey on the yield and quality of tomato, corn, cabbage and lettuce crops (Peterson et al. 1979; Smith and Hadley 1988,1989; Montagu and Goh 1990). However, little research has been conducted using organic fertilizers for transplants. The objective of this study was to evaluate the potential of several organic wastes from the agri-food industry for growing greenhouse tomato transplants.

Seeds of greenhouse tomato (*Lycopersicon esculentum* Mill. 'Vision') were sown in flats containing a commercial peat mix (Pro-Mix PGX™, Premier Peat Moss Ltd., Rivière-du-Loup, PQ). Two-week-old seedlings were transplanted into 12.5-cm standard pots (one per pot) containing the peat–compost growing medium. This transplant medium consisted of one part compost and three parts blond peat (vol vol^{-1}), amended with dolomitic and calcitic limestone to adjust the pH to 5.5–6.0. The compost consisted of farm manure (cow, chicken), peat and bark left for 18 mo in large, aerated windrows. The chemical composition was 1.6% N, 0.6% P and 1.4% K, with a C/N ratio of 28.

One of 13 organic fertilizers was applied. Canola meal and soybean meal were obtained from a feed store, wheat bran from a grocery store, feather meal from a garden center (Sanimal, Inc., Montréal), cottonseed meal from the Garden Grow Co. (Independence, OR), alfalfa meal from AgroCentre Belcan, Inc. (Sainte-Marthe, PQ), blood meal and meat meal from Canagro (Elmira, ON), crab-shell meal and fish-scale meal from W. E. Acres Crabmeal Ltd. (Cap Pelé, NB), fish meal from Madelipêche, Inc. (Montréal, PQ), distiller's dried grains from Seagram Company Ltd. (Montréal, PQ), and dried whey sludge from Vermont Organic Fertilizer Co. (Montpelier, VT). All fertilizers consisted of dried and ground material, except for whey, which was granulated in small pellets. A sample of each product was analyzed for total N-P-K (Table 1). Samples were first ashed at 550°C; this was followed by HCl digestion. Total N was measured by colorimetry with Nessler's reagent, P was determined by colorimetry using a molybdovanadate procedure, and K was analyzed using atomic absorption spectrometry. Fertilizer was incorporated into the peat–compost medium at a rate of 0.67 g N (dry-weight basis) L^{-1} of substrate. Control consisted of medium receiving no organic fertilizer.

Plants were grown in a glasshouse on raised benches where day/night air temperatures of 22°/16°C were maintained. Except for the sowing media, standards of organic certification programs (OCIPB 1992) were followed throughout the experiment. Saucers were placed under the pots to prevent loss of leachate. Water was hand applied. All plants

Table 1. Effect of organic fertilizers on growth of greenhouse tomato transplants, cv. Vision

Organic fertilizers	Nutrient content of fertilizers (total N-P-K)	Shoot dry weight (g plant^{-1})
Blood meal	12.5-1.1-1.0	18.5*ab*
Feather meal	13.6-0.3-0.2	17.3*abc*
Meat meal	7.7-3.1-0.7	16.3*abcde*
Crab-shell meal	8.2-1.5-0.5	18.8*a*
Fish-meal (ocean perch)	10.1-4.5-0.5	17.1*abcd*
Fish-scale meal	10.0-3.7-0.1	15.8*bcde*
Canola meal	6.0-1.1-1.3	10.8*fg*
Cottonseed meal	6.5-1.1-1.6	16.2*abcde*
Soybean meal	7.5-0.7-2.4	14.4*de*
Distiller's dried grains	4.3-0.9-1.1	14.5*cde*
Wheat bran	2.9-1.4-1.3	13.5*ef*
Alfalfa meal	2.5-0.3-1.9	10.8*fg*
Dried whey sludge	5.3-2.5-0.9	18.3*ab*
Control (without fertilizer)		10.3*g*
Standard error (mean)		±1.6

a–g Means within columns followed by a common letter are not significantly different at the 5% level, according to the Waller–Duncan multiple-range test.

were harvested 35 d after transplanting, corresponding to the appearance of the first flower cluster. At that time, plants with fertilizer showed little or no nutritional deficiencies, whereas plants without fertilizer (control) were yellow. The above-ground portion of each plant was cut and placed in an oven for 72 h at 60°C for dry-weight determination.

Treatments were arranged in a randomized complete block design with five replications and one pot per experimental unit. Data were subjected to analysis of variance, and means were separated by using the general linear model of the Statistical Analysis System Institute, Inc. (1985), and means were reported by Waller–Duncan multiple-range test.

Blood, feather, meat, crab-shell, fish and cottonseed meal, as well as dried whey sludge, significantly increased ($P = 0.05$) the shoot dry weight by 57–83% compared with control plants, which did not receive any fertilizer (Table 1). Except for cottonseed, plant wastes were less favorable for plant growth. This difference may be partly related to the easier degradation of the nitrogenous structural components of animal and dairy products in comparison with plant materials. On the other hand, Rubins and Bear (1942) observed that carbon compounds like cellulose and hemicellulose, which compose plant residues, are easily broken down and then can exert a considerable depressing effect on the nitrification of the low-N materials. This could cause temporary immobilization of N in the soil, which would thus interfere with plant growth.

Alfalfa meal and canola meal did not significantly increase ($P = 0.05$) the dry weight, compared with the control (Table 1). Moreover, these media and that amended with wheat bran delayed growth and caused distorted leaves in the first weeks after transplanting. These results could be due to excessive ammonia or to the decomposition of certain constituents, such as the sulfur-containing metabolites in brassica crops like canola, to a level toxic for plant growth. Weigle et al. (1982) noted a greater number of distorted leaves on impatiens plants having an NH_4^+-N source. In addition, Ells et al. (1991) reported toxic effects of alfalfa residue on the growth of cucumber seedlings, and they attributed this inhibition to ammonia that was released upon decay in the soil.

Organic wastes derived from slaughterhouses (feather, blood and meat meal), fish and seafood processing (fish and crab-shell meal), and cheese making (whey) have been shown to be the best sources of organic fertilizers. Despite the lower overall beneficial effect of plant material, cottonseed meal can also be successfully used for growing tomato transplants.

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