the harvest season progresses (6). Quite often, some fruit ripening in April are not harvested because of low prices or no available market. Plants set on October 1 produced a greater January fruit yield, but daughter plant production was also greater than those plants set at a later date. Daughter plant production in the fruiting field increases labor costs since growers detach them from the mother plant and destroy them. Another problem some growers encountered when transplanting the 'Dover' cultivar in early October is that plants became excessively large and fruited poorly. This is believed to result from placing vigorously growing transplants directly from the nursery into a highly fertilized fruiting field. Only slight transplant 'shock' occurs, and plants remain vegetative longer. Growers who anticipate this problem should delay transplanting until October 15. This problem may also occur with other strawberry cultivars.

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RESPONSE OF TOMATOES TO FERTILIZER RATES AND WITHIN ROW PLANT SPACING IN TWO AND FOUR ROW PRODUCTION SYSTEMS[1]

A. A. CSIZINSZKY
University of Florida, IFAS,
Agricultural Research & Education Center,
5007 - 60th Street East, Bradenton, FL 33508

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Abstract. **Response of 'Walter' tomato** (Lycopersicon esculentum **Mill.) to two types of row arrangements between lateral irrigation furrows, two fertilizer rates and three within-row plant spacings was evaluated for 2 seasons on Myakka fine sandy soil. Yield per ha was influenced by plant density only. Closer within-row spacing reduced fruit number but had no effect on fruit size, except in the fall with the two-row system when fruit size was best at 76 cm spacing. Production system with 4 rows between lateral furrows (4860 m row/ha) had a higher per ha yield than a system with 2 rows between lateral furrows (3650 m row/ ha). In the spring, higher fertilizer application (44.6 kg of 18-0-25 + 2 and 11.5 kg of superphosphate per 100 m row) did not result in higher yield or larger fruit size than the lower fertilizer rate (29.7 kg 18-0-25 + 2 and 11.5 kg superphosphate per 100 m row). In the fall, fruit size was larger wiwthin the lower fertilizer rate.**

In west central Florida, staked fresh market tomatoes are produced with various plant bed arrangements, fertilizer quantities, and in-row plant spacings. For example, in the single bed system, one bed, 91.5 cm (3 ft) wide and 23 cm (9 inches) high is formed between 2 lateral irrigation ditches which are 3.81 m (12.5 ft) apart. In the double bed system, plant beds with 1.98 m (6.5 ft) centers, between 2 irrigation furrows 5.64 m apart, are formed. On some farms, 4 beds, with 1.98 m centers, are made between irrigation furrows 9.91 m apart. The different plant bed arrangements result in various net linear row-meter (m) per hectare (ha). In the single, double and 4-bed arrangements above, there are 2625, 3546 and 4036 linear row m/ha, respectively.

Fertilizer application also varies from 145 to 390 kg of N/ha. Phosphorus (20% P_2O_5), containing fritted micronutrients, is applied at a rate of 123 kg/ha. Potassium is applied at a rate of 1.4 to 2 times that of N (4, 5, 6). Presently, fertilizers are recommended on an area (ha or acre), rather than on a 100 linear m-row (100 linear ft) basis. In view of the many different plant bed arrangements, fertilizer recommendations based on area are rather confusing. Plant density/ha varies with the number of linear m of bed/ha and with the in-row spacing. Seedlings are set at 51 cm (20 inches), 71 cm (28 inches), 76 cm (30 inches), or 81 cm (32 inches) apart in the bed, depending upon the individual grower. Thus, plant population per ha in the single bed production system may vary from 3240 at 81 cm in-row spacing, to 5,140 plants/ha, at 51 cm in-row spacing.

Growers are divided as to the advantages or disadvantages of the various plant bed arrangements and in-row plant spacings. Many have the opinion that fewer linear m of plant bed per ha and increased in-row spacing of plants is more economical. This arrangement requires less input of labor and materials, while fruit size and per plant yield is higher with increased in-row plant spacing.

Previous research indicated no yield or fruit size increase with fertilizer rates exceeding 300 kg N/ha (270 lb./A) (2, 3, 7). Plant bed arrangements on yield and fruit size have not been investigated to date.

This report presents the results of a study conducted to evaluate the effects of plant bed arrangements, fertilizer rates and in-row spacings on yield, fruit number and fruit size of fresh market tomatoes with seepage irrigation.

Materials and Methods

Experimental design was split plot with 4 replications. Main plots were 2 fertilizer rates, low and high, and sub plots were 3 in-row plant spacings. Treatments were randomized and replicated 4 times. Soil was Myakka fine sand (1) with the spodic layer at 71 cm below the surface.

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Plots were established in a double and in a 4-row arrangement.

In the double bed arrangement, 76 cm wide and 23 cm high beds were formed with 137 cm centers between 2 lateral irrigation furrows 5.49 m apart, for a total of 3640 m row/ha. In the 4-bed arrangement, distance between irrigation furrows was 8.24 m for a total of 4,850 m row/ha.

Fertilizer plots were 25 m long. In both plant bed arrangements, 1.5 kg of 18-0-25 + 2, 1.5 kg of 38-0-0 and 11.5 kg of superphosphate (20% P_2O_5) per 100 m bed was incorporated in the soil. The superphosphate also contained fritted micronutrients at a rate of 40 kg/mt. In the low fertilizer treatment, 29.7 and in the high fertilizer treatment, 44.6 kg of 18-0-25 + 2 per 100 m long bed (20 and 30 lb./100 ft, respectively), was applied in 2 bands at 25 cm from the bed center.

Soil was fumigated with MC-33 (66% methylbromide) at a rate of 3 kg/100 m bed and the entire bed was covered with a 1.25 mil thick black polyethylene mulch. Five week old seedlings of the cv. 'Walter PF' were set in 7.63 m long sub plots at 46, 61 and 76 cm in-row spacings on March 16, 1978. In the fall the same proceedings were followed, except that white colored polyethylene mulch was used. Seedlings were set in the field on Sept. 21.

Total soluble salts (TSS) by the saturated paste method (8), in soil samples were analyzed after transplanting and after harvest from 3 locations across the plant bed and at 3 depths, 0-5, 5-10, and 10-15 cm. Soil samples for moisture determination by the gravimetric method were taken every 10 days. Irrigation water and open pan evaporation readings were taken daily. At harvest, weight and number of fruits larger than 52 mm diameter (2 4/32 inches) were taken from 8 plants per sub plot. Fruit in both seasons was harvested 3 times at 7-day intervals.

Results and Discussion

Irrigation, rainfall and open pan evaporation data from the spring and fall seasons are presented in Table 1. During the spring, due to the higher rainfall, less irrigation water was applied than during the fall. However, total amount of water, irrigation plus rain, received by the crop during the 2 seasons was almost the same. The daily average amount of irrigation water required to keep the water flowing through the lateral ditches was also very close during the 2 seasons.

Table 1. Water received by tomatoes, 1978.

	Season	
	Spring	Fall
Number of irrigation days	60.5	75.5
Irrigation water, mm	556.2	729.3
Rain, mm	312.0	152.1
Total water, mm	868.2	881.4
Avg irrigation water per day, mm	9.19	9.66
Evaporation, mm	477.9	328.00
Avg evaporation per day, mm	5.76	3.61

In the spring, fertilizer treatments had no significant effect on tomato yield, number of fruit harvested or fruit size (Table 2).

Main effect of in-row spacing was significant with the 4-bed arrangements on the per plant yield and on the number of fruit harvested per plant (Table 2). The higher yields per plant with increasing in-row spacing were the result of greater number of fruit per plant and not larger fruit size.

In the fall, main effect of fertilizer was significant on fruit size. In both the 2 and 4-bed arrangements, plots which received N and K_2O at a rate of 5.34 and 7.42 kg per 100 m long bed, respectively (3.6 lb. N and 5.0 lb. K_2O per 100 ft row) had heavier fruit than plots treated with 50% higher amount of fertilizer (Table 2).

Plant spacing affected yield, number of fruit harvested and fruit size (Table 2). Yield per plant increased with increasing in-row plant spacing. The larger yield per plant with increased plant spacing in the 4-bed arrangement was the result of higher number of marketable fruit per plant and not larger fruit size. In the double bed arrangement, however, fruit size and number of fruit per plant both

Table 2. Main effects of plant bed arrangement, fertilizer rate and plant spacing on tomato fruit yield, number of fruits, and mean fruit weight.

	Plant bed arrangement between lateral irrigation furrows									
	two	four	two	four	two	four	two	four	two	four
	Yield				Number of fruits				Fruit size (gm)	
Treatment	kg/plant		mt/ha		per plant		per ha x 1000			
					Spring 1978					
Fertilizer[z]										
Low[z]	3.27	2.35	19.9	19.4	27	21	167.3	167.4	117	115
High[z]	2.55	2.70	15.6	20.7	23	24	152.3	196.7	112	112
F value[y]	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Plant spacing										
46 cm	2.56	1.89	20.4	21.4	22	18	173.4	186.0	117	115
61 cm	2.73	2.77	16.4	22.4	24	25	141.3	198.2	111	112
76 cm	3.43	2.87	16.4	18.3	30	25	142.2	161.9	116	113
F value[y]	NS	+	NS	NS	NS	*	NS	NS	NS	NS
					Fall 1978					
Fertilizer[z]										
Low[z]	3.55	3.71	21.6	29.8	23	24	139.1	190.0	156	157
High[z]	3.49	3.27	20.9	25.3	23	28	137.3	186.0	152	141
F value[y]	NS	NS	NS	NS	NS	NS	NS	NS	+	*
Plant spacing										
46 cm	2.78	2.79	22.2	29.5	18	19	146.4	199.3	152	148
61 cm	3.50	3.53	21.2	27.9	23	23	139.0	185.3	152	150
76 cm	4.18	4.25	20.3	26.7	27	28	129.0	179.5	159	149
F value[y]	**	**	NS	+	**	**	NS	NS	*	NS

[z]Low fertilizer rate:29.7 kg, high fertilizer rate:44.6 kg of 18-0-25 + 2 per 100 linear m of plant bed.
[y]+, *, ** denotes significance at the 10%, 5% or 1% level respectively, NS, not significant.

contributed to higher plant yield but only at the 76 cm (30 inches) in-row plant spacing. Yield per ha was significantly higher in the 4-bed arrangement with closer in-row spacing, that is, increasing plant population.

In the experiments, the application of high amounts of fertilizers for tomatoes did not increase yield, number of fruit harvested, or fruit size. With higher fertilizer rates, higher amounts of residual salts remained in the soil. Residual soil salt content also increased with increasing in-row plant spacing (Table 3). Higher number of plants/ha, regardless of the type of plant bed arrangements, would increase yield and reduce residual soil salt content.

Table 3. Total soluble salts in soil solution as measured by the saturated paste extract method, spring and fall 1978.

			Fertilizer treatment			
			Low[z]		High[z]	
		Within row plant spacing (cm)	Plant bed arrangement between lateral irrigation furrows		Plant bed arrangement between lateral irrigation furrows	
Sampling date	Soil depth (cm)		Two	Four	Two	Four
			ppm			
Spring						
Mar. 15, 1978	0-15		126,580	126,580	174,590	174,590
June 10, 1978		46	48,760	55,560	105,740	125,950
		61	58,550	65,260	114,880	124,220
		76	65,860	73,010	125,710	145,980
Fall						
Sept. 21, 1978	0-15		153,390	153,390	234,410	234,410
Dec. 12, 1978		46	37,460	37,540	30,710	73,560
		61	40,580	44,810	45,590	75,060
		76	56,200	47,610	76,420	80,420

[z]Low fertilizer rate: 29.7 kg, high fertilizer rate: 44.6 kg of 18-0-25 + 2 per 100 linear m of plant bed.

The 4-bed arrangement between two lateral irrigation furrows, however, has several disadvantages compared to the 2 or single bed production systems. The disadvantages of the 4-bed system are: it requires more input of materials and labor, it is more difficult to collect the harvested fruit, and the drainage of water from the land after a heavy rainfall is slower.

These adverse factors of the 4-bed arrangement have to be taken into consideration against the higher marketable yield potential of this system when selecting plant bed spacing between lateral irrigation furrows for fresh market tomato production.

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INFLUENCE OF FERTILIZER RATES AND PLASTIC MULCH ON THE PRODUCTION OF TWO CULTIVARS OF CRISPHEAD LETTUCE[1]

PAUL H. EVERETT
University of Florida, IFAS,
Agricultural Research Center,
Rt. 1, Box 2G, Immokalee, FL 33934

Abstract. **Three rates, 420, 700 or 920 lb./acre (470, 784 or 1030 kg/ha), of an 18-0-25 fertilizer, with and without mulch, were evaluated for their effect on yield and head weight of 2 crisphead lettuce cultivars grown on a sandy soil in southwest Florida. In addition to the 18-0-25 fertilizer, all plots received a 5-8-8 fertilizer at a rate of 500 lb./acre (560 kg/ha). All fertilizer for the mulched plots was applied pre-plant. In the non-mulched plots, all of the 5-8-8 and one-half of the 18-0-25 fertilizers were applied pre-plant. The remainder of the 18-0-25 fertilizer was applied to the non-mulched plots 3 weeks after transplanting. Lettuce cultivars used were 'Shawnee' and 'Ithaca.'**

The use of plastic mulch resulted in a highly significant increase in weight of lettuce per acre, average weight per head, and the number of heads weighing 1.7 lb. (0.77 kg) or more. Plastic mulch did not increase the total number of heads per acre. The effect of fertilizer rates and cultivars on yield and average head weight was not significant.

The season had higher than normal rainfall. Without plastic mulch, severe leaching of plant nutrients occurred, even at the highest rate of fertilizer. With plastic mulch, plant nutrient level in the soil was adequate even at the low rate of fertilizer. Consequently, the primary effect of mulch on improved lettuce production was in reducing the leaching of plant nutrients.

Between 14 and 15 thousand acres of lettuce are grown in Florida annually. Most of this acreage is on the organic soils centered around Lake Okeechobee, Zellwood, Lake Placid, and Sarasota. Very little lettuce has been grown commercially on the mineral soils of the state. It appeared feasible to expand lettuce, particularly head type, production in Florida (9). This opportunity has become even greater during the past 5 years, due mainly to the rapid increase in transportation costs from California to eastern

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