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CULTURAL STUDIES ON TOMATOES FOR PROCESSING

1978

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1978 RESEARCH REPORT ON TOMATOES FOR PROCESSING

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Studies on culture and physiology of tomatoes for processing were conducted at 3 locations of OARDC--Main Campus, Wooster; Green Springs Crops Research Unit, Green Springs; and the Northwestern Branch, Custer.

Research on the Wooster campus is usually of the preliminary nature and requires frequent observation and data collection. The soil is a Wooster silt-loam with good uniformity throughout the plot area. The plots received 700 lb/A of 10-20-20 fertilizer after plowing, but before final discing and fitting for planting. No additional fertilizer was applied. Diphenamid and chloramben were used for weed control according to standard recommendations. Other pesticides were applied according to recommended practice. No serious problems with weeds, insects or diseases occurred. Rainfall and temperature data are summarized in Table 1.

Soil at the Green Springs Unit is a fine sandy loam and also uniform throughout the experimental area. Except where fertilizer nutrients were under study, 500 or 600 lb/A of 6-24-24 was applied pre-plant broadcast. Herbicide, insecticide, and fungicide materials and applications were similar to the Wooster studies and according to recommended procedures. Rainfall was generally adequate at this location (Table 1). No serious weed, insect, and disease problems occurred.

Soils at the Northwestern Branch are classed as Hoytville clay and reasonably uniform, although some variation is present. All plots were bedded in the fall using a power bedder. Beds were on 60-in. centers with 48-in. top and furrows 6-8 in. deep. Prior to planting in the spring, the beds were very lightly worked (1" deep) and re-shaped with the power bedder, unless tillage was part of the study. P and K were applied in the fall at a rate of 1200 lb/A as 0-26-26 after plowing but prior to bed formation. N was broadcast at a rate of 70 lb/A of N in the spring prior to bed re-shaping except in plots where N was under study. Pesticide programs were according to recommended practice and were very adequate as no serious weed, insect, or disease problems occurred throughout the season.

WOOSTER STUDIES

-Cytex & DPX 4891-

Transplants of Campbell 37 were field set on May 23 in 5-ft. rows with 11-in. between plants. Experimental chemicals used were "Cytex", a mixture containing cytokinins which has shown promise of increasing fruit set, and DPX 4891 which appears effective in reducing ozone injury. The materials were applied in water at 60 gal. per acre. The rates and time of applications as well as results are presented in Table 2. Harvest was a single destructive picking on Sept. 5.

Observations throughout the season gave no indication that the chemicals were having any effect on the plants. Conditions were generally good for fruit set and there was no apparent ozone injury to any of the plants. Data indicate

TABLE 1.--Available Temperature and Rainfall Data

	<u>Temperature</u>		<u>Rainfall (in.)</u>	
	1978	20-Year Avg.	1978	20-Year Avg.
<u>Northwestern Branch</u>				
April	46.4	49.3	4.36	3.14
May	58.1	60.1	3.57	3.27
June	69.1	69.3	2.90	3.49
July	71.2	72.2	1.49	3.98
August	70.5	70.4	1.94	2.93
September	67.9	64.5	2.00	3.11
<u>Wooster Campus</u>				
April	46.2	48.1	3.19	3.14
May	57.1	58.4	4.89	3.85
June	66.8	67.5	3.81	3.87
July	68.6	71.4	1.52	3.99
August	69.7	69.7	3.64	3.51
September	65.9	63.4	1.78	3.06
<u>Green Springs Unit</u>			<u>Rainfall 1978</u>	
April			3.23	
May			3.26	
June			4.87	
July			2.19	
August			3.92	
September			1.31	

TABLE 2.--Influence of Growth Regulators on Yield of C-37 Tomatoes - Wooster, 1978.

Treatments	Yield						Total tons/a
	Ripe		Green		Rotted		
	tons/a	%	tons/a	%	tons/a	%	
1. Check	31.8	75.5	8.3	20.5	1.6	3.9	41.8
2. Cytex 1/2 gal/A -when plants were established(6-5)	34.6	74.4	7.7	19.2	3.0	6.2	45.3
3. Cytex 1 gal/A "	37.1	76.6	9.1	19.1	1.9	4.2	48.2
4. Same as 2 + 1/2 gal. when Cl.#2 full bloom(6-30)	35.9	78.0	8.1	18.5	1.5	3.3	45.5
5. Same as 3 + 1 gal. when Cl.#2 full bloom (6-30)	29.9	70.1	10.7	25.2	2.0	4.6	42.6
6. Cytex 1/2 gal/A Cl.#2 in full bloom (6-30)	33.2	74.7	8.9	20.7	2.0	4.5	44.2
7. Cytex 1 gal/A Cl.#2 in full bloom (6-30)	32.3	74.3	8.5	19.0	2.9	6.5	43.7
8. DPX-4891 = 1 lb/A weekly from 6-15 to 8-11	36.0	83.6	5.8	13.2	1.3	3.1	43.2

No statistically significant differences

Transplanted: 5-23-78

Harvested: 9-5-78

Weather June 5 - partly sunny, 70°F., 1 p.m.

June 30 - partly sunny, 83°F, 1 p.m.

TABLE 3.--Influence of Ethephon, Pace and Alar on Fruit Ripening and Yield of C-37 Tomatoes - Wooster, 1978

Treatment	YIELD						Total tons/a
	Ripe		Green		Rotted		
	tons/a	%	tons/a	%	tons/a	%	
Check	30.4	71.8	10.0	24.8	1.3	3.4	41.8
Ethephon .8 lb/A	31.5	79.0	5.4	15.6	1.9	5.3	38.7
Ethephon .4 lb/A	30.5	79.4	5.9	16.9	1.4	3.7	37.8
Ethephon .8 lb/A+Pace 1 pt/A	30.5	79.7	4.9	13.5	2.5	6.7	37.9
Ethephon .4 lb/A+Pace 1 pt/A	32.4	75.8	7.8	19.7	1.8	4.5	42.1
SADH 5000 ppm	28.4	72.2	7.6	21.4	2.3	6.4	38.3
Ethephon 1 pt/A	28.1	75.5	6.6	18.6	2.0	5.9	36.6
LSD .05	NS	NS	2.3	NS	NS	NS	NS

Ethephon at .8 and .4 lb/A for ripening applied on 8-18 - 10:30 a.m., 76°F., sunny.
 SADH and Ethephon applied for growth control applied 8-11 - 10:30 a.m., 72°F, sunny.

that the treatments had no statistically reliable influence on yield. Nevertheless, it appears that the study is worthy of repeating in 1979 at another location and perhaps under more adverse fruit-setting conditions.

-Ethephon - SADH Study-

The objectives of this study were to attempt to improve the effectiveness of ethephon for fruit ripening with an adjuvant and to evaluate ethephon (Ethrel) and SADH (Alar) for stopping late plant growth and/or fruit set to improve ripening uniformity. Transplants of Campbell 37 were set on May 23 in 5-ft. rows at 11-in. spacing.

The chemicals were applied with water at 60 gal. per acre. Rates of ethephon for ripening were .4 and .8 lb. (1 5/8 pt. and 3 1/4pt. of Ethrel) per acre. The adjuvant was "Pace" and it was added at the rate of 1 pt. per acre. Treatments to stop late-season growth were 1 pt. per acre of "Ethrel" and 5000 ppm "Alar". The ripening treatments were applied on August 18 at 10:30 a.m., temperature was 76°F. The majority of the fruits were mature green and 5-10% were red or turning. The growth treatments were applied on August 11 when a late flower cluster was developed but the flowers were not open.

Results (Table 3) indicate that the addition of an adjuvant did not improve the effectiveness of ethephon (Ethrel formulation) for fruit ripening. Yield of ripe fruits was not affected by any treatment but the amount of green fruits was reduced by ethephon treatment regardless of the addition of adjuvant. There appeared to be considerable variability in the data and there was insufficient replication to remove this variability, consequently the reliability of the results is doubtful.

The ethephon treatment of 1 pt. per acre of Ethrel effectively caused blossoms to fail to develop into fruits. The SADH treatment did not influence flower and fruit development but did appear to reduce plant growth. This aspect certainly needs further study to develop methods for reducing late-season vegetative growth.

GREEN SPRINGS STUDIES

-Transplant Handling-

A study was conducted with Mr. L. A. Risse, USDA Laboratory, Orlando, Fla. to evaluate plant handling methods in Georgia on subsequent production in Ohio. Plants of Campbell 28 were selected from the same location in Georgia and handled as follows: 1) Hand pulled, tied in bundles with twine in the field, handled in bulk to a packing shed, there placed into crates for shipment; 2) Hand pulled, tied and packed in shipping crates in the field; 3) Hand pulled and packed without bundling (loose) in the field; 4) Machine dug and packed without bundling in the field.

Plants were pulled on May 18 and shipped to Fremont, Ohio with the cooperation of the H.J. Heinz Co. The plants arrived on May 20 and were stored in a refrigerated room (about 45°F) until planting on May 22. Samples were randomly

taken from each treatment prior to planting and data recorded on plant size, broken stems and weeds. No sorting was done when planting, except to remove weeds. Stand count was taken one month after planting and plant height and width was recorded. Ripe fruits were harvested on Aug. 14 and Aug. 22 and all remaining ripe and green fruit were harvest on Aug. 28.

Data (Table 4) revealed that handling method had no apparent influence on stand establishment, plant growth, earliness and yield. However, planting conditions were excellent for plant recovery and it appears this trial should be repeated under more adverse transplanting conditions.

-Transplant Rooting Study-

"Transplantone", a commercial preparation containing naphthaleneacetamide and naphthaleneacetic acid was used in the transplant water to study its effect on plant recovery. Rates used were 0.5 and 1.0 lbs. per 100 gal. and 0.5 pt. per plant. The water also contained 6 lb. per 100 gal. of starter (10-52-17). The plants were southern-grown bare-root plants and were set on May 26.

Data (Table 5) suggest that the plant regulator treatment had no apparent influence on stand establishment, plant growth, and total yield. A trend appeared on earliness but this needs further study.

NORTHWESTERN BRANCH STUDIES

-Nitrogen Source and Method of Application on Fall Beds-

Incorporating nitrogen fertilizers is usually a desirable practice to prevent loss due to surface erosion and volatilization. However, fall-prepared beds should be worked only a very minimum prior to planting in most northwestern Ohio soils. This study was designed to examine various nitrogen sources using 3 methods of application for fall bedded tomatoes.

Nitrogen sources were ammonium nitrate, urea, liquid N (28%), and calcium nitrate. All were applied at the rate of 80 lb/A of N except for the check treatment which received no N. The methods of application were: 1) broadcast on top of bed with no incorporation; 2) broadcast on top of bed and incorporated 1 in. deep with rotary tiller of the power bedder; 3) chisel 2 in. deep, 6 in. each side of the row. The applications of N were made the same day of planting. Transplants of Campbell-37 were planted on May 28, using a commercial transplanter which also applied a starter solution which contained a small amount of N plus higher amounts of P and K. Harvesting was done with an FMC harvester on September 6.

No great differences in plant growth and development were apparent during the growing season except that plants in the check plots were slightly smaller and a lighter green color than the other plants. Further, fruit maturity and plant senescence did not appear to be greatly influenced by fertilizer treatment. Data in Table 6 indicate that the field observation on maturity effects were indeed the case.

TABLE 4.--Influence of Plant Handling in Georgia on Stand Establishment and Yield of C-28 Tomatoes, Green Springs, 1978.

Treatment	Yield - Tons/Acre				Stand count 6-21	Plant size 6-21	
	8-14	8-22	8-28 (green)	Total			
Bundled - Shed Packed	4.5	9.3	17.1	2.1	33.0	33	97
Bundled - Field Packed	4.7	9.4	19.9	2.6	36.6	32	99
Loose - Field Packed	5.1	8.4	19.2	2.4	35.1	31	98
Loose - Machine Harvested	4.9	9.7	19.9	2.3	36.9	35	98

No statistically significant differences between any treatment means

Stand Count = No. of plants in a 30' row.

Plant Size = Product of Width x Height in inches.

TABLE 5.--Influence of "Transplantone" on Stand Establishment and Yield of C-28 Tomatoes, Green Springs 1978

Treatment	Yield Tons/Acre				Stand count 6-21	Plant size 6-21	
	8-15	8-23	8-31 (green)	Total			
Control	2.8	7.6	26.3	2.6	39.4	30	96
0.5 lb/100 gal.	3.3	9.2	25.6	2.2	40.2	30	96
1.0 lb/100 gal.	3.6	9.4	24.7	2.1	39.8	33	95

No statistically significant differences between any treatments

Stand Count = No. of plants in a 30' row

Plant Size = Product of width x height in inches

Yield was uniformly low from all treatments (Table 6) but the "%" ripe was significantly higher from plots receiving no nitrogen. One reason why the yield was so low was the inability of the harvester to shake all fruits from the vines. However, several fruit counts were made following the harvester and the amount of fruit left on the vines was uniform throughout the plots. Therefore, the yield results are comparable. Fertilizer had no influence on the incidence of blossom-end rot which was a serious problem in this dry season.

-Storage of Pre-Germinated Seeds for Plug Mix Seeding-

Pre-germinating seeds used with the Plug-Mix seeding method has shortened emergence time by several days and is usually a desirable practice. However, what does one do with the pre-germinated seedlings if adverse weather precludes planting on schedule? This study was a continuation of previous studies on storage of pre-germinated seed which indicated that seed germinated at 80°F for 48 hours in moist vermiculite could be kept for up to 6 days with a somewhat delaying effect on emergence but no serious reduction in yield. Longer storage of up to 10 days had a greater delaying effect on emergence but also did not seriously reduce yield.

Campbell 37 was the variety used in this study. Treatments were: 1) no pre-germination; 2) pre-germinated but no storage; 3) pre-germinated and stored for 4 days; 4) pre-germinated and stored for 8 days. Germinating conditions were in trays of moist vermiculite at 80°F for 48 hours. For storage, the seedling-vermiculite mixtures were kept in the trays and placed in plastic bags to prevent dehydration and placed in 40°F refrigerated rooms for the indicated number of days. On the day of planting the correct amounts of seed or seedling-vermiculite mix to give 14.2 gms per bushel of mix, were mixed with the commercial "Jiffy Plus" mix or composted hardwood bark. Additional treatments of No. 4 vermiculite without pre-germinated seeds; John Deere 33 vegetable seeder plus vermiculite anti-crustant; and transplants were included as controls for comparisons in the study. The plug mix seeder was set to deliver 1/4 cup of mix per hill spaced 11 in. between drops. The John Deere vegetable seeder was set to clump plant at similar spacing. All plots received 70 lb/A of N pre-plant and tilled in 1 in. deep. Seeding was done on May 10 and transplanting on May 28.

Stand counts and plant height measurements were made on June 22. Plots were harvested by machine on September 14.

Pre-germination accelerated emergence by about 5 days and the plants from pre-germinated seed were larger on June 22 (Table 7). Storage of the germinated seed of 4 or 8 days at 40°F. had no serious effect on emergence but the 8 days storage treatment slightly delayed emergence. Stand was satisfactory from all treatments although the plug-mix plantings had more hills per 30 ft. of row than the standard John Deere 33 seeder plus vermiculite as an anti-crustant. The composted hardwood bark did not feed well in the Plug Planter and its use is thus, questionable.

There were no apparent treatment effects on yield. However, the transplants were past optimum maturity even though the amount of rots does not indicate this. Many of the rotted fruits had dried up and were not removed from the vines during harvest.

TABLE 6.--Influence of Source of Nitrogen and Method of Application on Yield of Processing Tomatoes; Northwestern Branch, 1978

Treatment	Ripe		Green		Rotted		BER		Total T/A
	T/A	%	T/A	%	T/A	%	T/A	%	
Check	9.3	69.4	2.4	20.2	.4	3.6	.8	6.8	13.0
Am.Nitrate-Top only	7.5	55.8	4.6	34.2	.3	2.0	1.1	8.0	13.4
on top rotate 1"	8.4	57.0	4.6	32.2	.3	2.2	1.1	8.6	14.4
Chisel 2" deep - 6" each side of row	8.0	54.2	4.8	33.8	.3	2.3	1.3	9.6	14.4
Urea-on top	8.3	55.9	5.1	34.5	.3	2.1	1.1	7.5	14.9
on top rotate 1"	8.3	56.0	4.8	34.5	.3	2.2	1.0	7.2	14.4
Chisel 2" deep - 6" each side of row	7.8	53.1	5.2	37.6	.3	2.3	1.0	6.9	14.4
Liquid N-28% on top	7.9	58.8	3.8	30.5	.4	3.5	.9	7.1	13.2
on top rotate 1"	8.2	57.3	4.7	32.3	.4	2.9	1.0	7.4	14.4
Chisel 2" deep - 6" each side of row	7.3	53.8	4.5	33.7	.4	3.1	1.2	9.3	13.4
CA(NO ₃) on top	8.0	55.2	4.9	33.0	.4	2.8	1.3	8.9	14.7
on top rotate 1"	8.3	55.3	5.1	33.4	.3	2.1	1.4	9.2	15.2
Chisel 2" deep - 6" each side of row	8.3	53.9	5.1	34.9	.3	2.3	1.4	8.8	15.2
LSD .05	NS	8.38	NS	NS	NS	NS	NS	NS	NS

TABLE 7.--Relation of Pre-germination and Storage on Stand Establishment and Yield of Plug-Mix Seeded Tomatoes, Northwest Branch, 1978.¹

Treatment	No. Hills per row 6-21	Plant Ht. (in.)	Single Harvest Yield						Total T/A
			Ripe		Green		Rotted		
			T/A	%	T/A	%	T/A	%	
Jiffy Plus, No. Pre-germ.	38	7.65	11.0	79.2	2.3	17.5	.4	3.3	13.7
Pre-germ, 0 storage	40	8.70	10.2	78.7	2.3	18.6	.3	2.7	12.9
Pre-germ, 4 days storage	39	8.45	10.8	78.6	2.5	18.1	.4	3.2	13.7
Pre-germ, 8 days storage	39	8.60	9.5	76.2	2.5	20.6	.4	3.2	12.5
Bark Mix, No Pre-germ	34	7.75	11.5	77.8	3.0	20.2	.3	2.0	14.8
Pre-germ, 0 storage	40	9.50	9.9	80.6	2.0	16.3	.3	3.0	12.4
Pre-germ, 4 days storage	38	8.60	10.5	79.8	2.4	17.8	.3	2.4	13.2
Pre-germ, 8 days storage	37	8.50	11.5	80.7	2.4	17.0	.3	2.2	14.2
#4 Vermiculite, No Pre-germ	36	7.04	11.6	79.0	2.7	19.0	.2	1.9	14.6
Transplants	34	8.55	9.8	77.4	2.6	20.5	.2	2.0	12.6
John Deere Seeder & Vermiculite	31	7.30	11.1	79.7	2.5	18.1	.3	2.2	14.0
LSD .05 =	4.0	NS	NS	NS	NS	NS	NS	NS	1.03

1 Field seeded on May 10; transplants set on May 28, Plug-mix planter mfr. Mechanical Transplanter Co., Holland, MI. used for all treatments except John Deere seeder and transplants. Stand Count = No. of plants or hills per 30 ft. row.

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