

Report on ABR Tomato Trial at HARC Kunia Farm.
HARC project 120-309-5733
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Procedure

A trial testing LCF on tomato was installed at Kunia January 27, 2003. The plot area had been previously planted in tomatoes and had moderate to high levels of root-knot nematodes in some plots. The test field area was 90 ft x 4 ft (0.0083 A). Preplant 15-15-15 fertilizer was applied at the rate of 5 lb / 0.0083 A (602 lb / A) (90 lb N / A). Gypsum was applied at the rate of 398 lb / A. The plots were irrigated through drip tubing. Additional fertilizer was applied postplant through drip irrigation. Twelve gal N-K25 was applied to the test area on March 5, 2003 (1.03 K₂O lb / gal, 0.66 lb N / gal).

Tomato "Rutgers" was seeded in planting trays with potting mix. They grew in a greenhouse for five weeks before being transplanted to the field plots. Rutgers tomato cultivar is susceptible to nematodes and grows in an indeterminant manner.

There were three treatments: 1) LCF at 1:500 dilution, 2) base material from which LCF was made at 1:500, and 3) untreated check (water). Each treatment had four replicate plots in a randomized complete block. Each plot was 15 ft long and contained four plants. Treatments were applied as a drench to the seedlings in the trays just before planting and to the plants in the field plots at planting (1 ml / 500 ml water / plant) on January 27, 2003. A second application was made after one month on February 24, 2003 at the rate of 1 ml / 500 ml water / plant. A third treatment application was made on March 24, 2003 at the rate of 3 ml / 1500 ml water / plant. The untreated check plants received water alone in the same quantity as the treatments.

Problems with pin worm and fruit fly damage to green fruits were observed. Asana at 5 ml / gal (7 oz Asana / 40 gal water / A) was applied on March 24, 2003. After that, all developing fruits were bagged with paper sandwich bags as soon as they appeared.

Results

Growth and development data were taken on February 19, 2003. Plant height of each plant was measured in inches. A secondary growth rating on a scale of 1 to 5 was assigned based on the amount of secondary growth: 1 = no further secondary growth after transplant, 5 = much growth. Photographs were taken to illustrate plant rating scale. In addition, the number of flower bunches per plant were recorded. The results of plant height, secondary growth and flower bunch number are shown in Table 1. Analysis of Variance was run using Statistix for Windows. The difference between means was analyzed as Least Significant Difference at the 95% level. There were no significant differences between means, however the check measurements were lower than the LCF and base treatments for all three parameters.

Leaf samples for nutrient analysis were taken by Peter Bunn on March 17, 2003. They were analyzed by Brookside Laboratories, Inc. The results are attached. The N:K level was slightly higher than the 1:1 level expected. The N level was somewhat higher than expected at that age, but plant growth in our plots was slower than in a commercial field. There were no differences in tissue nutrients between treatments. The high Fe and Al levels measured were thought to be due to contamination of the samples with soil dust. The tissue nutrient analysis results are attached.

Tomato harvest began on April 7 and continued through May 19. There was a total of 19 harvest rounds. Tomatoes were harvested at first color break. Fruit number and total fruit weight in pounds per plot was recorded for each harvest round. Analysis of Variance and Least Significant Difference between means was run on each harvest round data and on the total harvest data. Results are shown in Tables 2, 3, and 4. The total fruit number and total fruit weight differences between treatment means were significant at the 90%, but not the 95% level. In both cases the LCF treatment was highest, the base material treatment next and the untreated check treatment the lowest. LCF differed significantly from the check. The base material treatment did not differ significantly from either. The average fruit weight for LCF was 0.36 lb, for base was 0.37 lb, and for check was 0.36 lb. Since there was no difference in average fruit weight, the difference in total fruit weight was due entirely to the difference in total fruit number between treatments. There was no significant difference in treatment harvest data based on harvest date. There was, therefore, no earlier fruit maturation in any of the treatments, nor was there a longer period of harvest in any of the treatments. For most of the harvest dates, the LCF treatment had the highest fruit number and weight harvested per plot (see Table 4 for harvest weight by date).

At the start of the project, soil populations of root knot nematodes were sampled. The subsamples were taken in six locations over the length of the test area. The nematode numbers in the first half of the test area were moderate to high while in the last half there were none to very few. The replicate plots 1 and 4 for all treatments were located in the first half of the trial area and for plots 2 and 3 in the last half. At the completion of the final harvest, the plants were pulled out and root damage by nematodes was assessed. Nematode damage was recorded for each plant on a rating scale reflecting knot numbers and secondary root loss. For knot number the scale was 1) = no knots, 2) = 20% of roots with knots, 3) = 50%, 4) = 75%, and 5) = all roots with knots. For secondary root loss due to nematodes the scale was: 1) = good root mass, 2) = some root loss, 3) = few roots left, 4) = very few roots left, and 5) no secondary roots. Thus in both rating scales 1 reflected good root condition and 5 very poor roots and much nematode damage. Because the plants were senescent by the end of the harvest, total plant weight was not measured.

As seen in Table 5, the number of root knots was lowest in LCF which differed significantly at the 95% level from the base material treatment. The check did not differ from either base or LCF. Since this makes no sense, I conclude that the results fell into the 5% chance that the difference was due to variation rather than a true treatment effect. The results for secondary root damage showed no difference between treatments. When

analyzed by replicate plot however, replicates 1 and 4 for all treatments had significantly more nematode damage than plots 2 and 3. This reflects the nematode population levels in the two halves of the test area as mentioned above.

Also included in Table 5 is an analysis of total fruit number harvested by replicate plots. A difference between replicates can be seen here also, although the difference between reps 2 and 4 is not significant, there is an overall trend of fewer fruit harvested in the plots that had the most nematode damage to roots.

Conclusion

LCF and the base material treatments both resulted in greater tomato fruit numbers than the untreated check. LCF treatment was slightly, but not significantly better than the base material. The increase in fruit number with LCF treatment or base material treatment occurred in both the heavily nematode-damaged plots and in the low nematode plots. The cost effectiveness of LCF use will depend on the value of the additional crop harvested versus the cost of LCF applications.

Trial LCF on Tomato at HARC Kunia Farm

Table 1. Kunia Tomato Trial Height, Growth and Flower Set

Analysis of variance table for **plant height** in inches

SOURCE	DF	SS	MS	F	P
REP (A)	3	4.16250	1.38750	0.35	0.7914
TRT (B)	2	7.32667	3.66333	0.92	0.4473
A*B	6	23.8200	3.97000		
TOTAL	11	35.3092			

LSD (T) Comparison of means of **plant height** by treatment

TRT	HOMOGENEOUS MEAN	GROUPS
LCF	10.175	I
Base	9.6750	I
check	8.3250	I

THERE ARE NO SIGNIFICANT PAIRWISE DIFFERENCES AMONG THE MEANS.
 CRITICAL T VALUE 2.447 REJECTION LEVEL 0.050
 CRITICAL VALUE FOR COMPARISON 3.4475
 STANDARD ERROR FOR COMPARISON 1.4089
 ERROR TERM USED: REP*TRT, 6 DF

Analysis of variance table of **plant growth rating**

SOURCE	DF	SS	MS	F	P
REP (A)	3	1.43069	0.47690	0.86	0.5095
TRT (B)	2	1.37352	0.68676	1.24	0.3534
A*B	6	3.31388	0.55231		
TOTAL	11	6.11809			

LSD (T) Comparison of means of **plant growth rating** by treatment

TRT	HOMOGENEOUS MEAN	GROUPS
Base	3.1250	I
LCF	2.7500	I
check	2.2975	I

THERE ARE NO SIGNIFICANT PAIRWISE DIFFERENCES AMONG THE MEANS.
 CRITICAL T VALUE 2.447 REJECTION LEVEL 0.050
 CRITICAL VALUE FOR COMPARISON 1.2859
 STANDARD ERROR FOR COMPARISON 0.5255
 ERROR TERM USED: REP*TRT, 6 DF

Table 1 continued

Analysis of variance of **numbers of flower bunches**

SOURCE	DF	SS	MS	F	P
REP (A)	3	32.9167	10.9722	1.03	0.4432
TRT (B)	2	12.1667	6.08333	0.57	0.5925
A*B	6	63.8333	10.6389		
TOTAL	11	108.917			

LSD (T) Comparison of means of **number of flower bunches** by treatment

TRT	HOMOGENEOUS MEAN	GROUPS
LCF	5.7500	I
Base	5.5000	I
check	3.5000	I

THERE ARE NO SIGNIFICANT PAIRWISE DIFFERENCES AMONG THE MEANS.
 CRITICAL T VALUE 2.447 REJECTION LEVEL 0.050
 CRITICAL VALUE FOR COMPARISON 5.6435
 STANDARD ERROR FOR COMPARISON 2.3064
 ERROR TERM USED: REP*TRT, 6 DF

Trial LCF on tomato at HARC Kunia Farm

Table 2. Analysis of Variance of Total Fruit Number Harvested

Analysis of variance of **total fruit number** harvested

SOURCE	DF	SS	MS	F	P
TRT (A)	2	4406.17	2203.08	2.52	0.1608
REP (B)	3	6344.92	2114.97	2.42	0.1648
A*B	6	5251.83	875.306		
TOTAL	11	16002.9			

LSD (T) Comparison of means of **total fruit number** by treatment

TRT	MEAN	HOMOGENEOUS GROUPS
LCF	130.00	I
Base	103.00	II
check	83.250	..I

THERE ARE 2 GROUPS IN WHICH THE MEANS ARE NOT SIGNIFICANTLY DIFFERENT FROM ONE ANOTHER.
 CRITICAL T VALUE 1.943 REJECTION LEVEL 0.100
 CRITICAL VALUE FOR COMPARISON 40.652
 STANDARD ERROR FOR COMPARISON 20.920
 ERROR TERM USED: TRT*REP, 6 DF

Table 3. Analysis of Variance Total Fruit Weight Harvested

Analysis of variance of **total fruit weight** harvested

SOURCE	DF	SS	MS	F	P
TRT (A)	2	565.906	282.953	2.72	0.1445
REP (B)	3	999.854	333.285	3.20	0.1049
A*B	6	624.927	104.155		
TOTAL	11	2190.69			

LSD (T) Comparison of means of **total fruit weight** by treatment

TRT	MEAN	HOMOGENEOUS GROUPS
LCF	46.688	I
Base	37.813	II
check	29.875	..I

THERE ARE 2 GROUPS IN WHICH THE MEANS ARE NOT SIGNIFICANTLY DIFFERENT FROM ONE ANOTHER.
 CRITICAL T VALUE 1.943 REJECTION LEVEL 0.100
 CRITICAL VALUE FOR COMPARISON 14.023
 STANDARD ERROR FOR COMPARISON 7.2165
 ERROR TERM USED: TRT*REP, 6 DF

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Table 4. Harvest treatment weight in pounds per treatment by harvest date

Trt	date	Trt	date	Trt	date	Trt	date
	<u>4/7</u>		<u>4/9</u>		<u>4/11</u>		<u>4/16</u>
base	.063	check	0.13	check	0.13	LCF	0.94
check	.063	LCF	0.13	LCF	0.13	check	0.56
LCF	0	base	0.63	base	0	base	0.13
Trt	date	Trt	date	Trt	date	Trt	date
	<u>4/17</u>		<u>4/21</u>		<u>4/23</u>		<u>4/25</u>
check	0.19	LCF	2.75	base	1.50	base	2.88
base	0.13	base	2.06	LCF	1.31	LCF	2.69
LCF	0.13	check	1.44	check	0.94	check	1.88
Trt	date	Trt	date	Trt	date	Trt	date
	<u>4/28</u>		<u>4/30</u>		<u>5/2</u>		<u>5/5</u>
LCF	5.0	check	3.0	base	2.63	LCF	7.44
base	3.44	base	2.94	check	2.56	base	5.31
check	2.38	LCF	2.69	LCF	2.56	check	3.44
Trt	date	Trt	date	Trt	date	Trt	date
	<u>5/7</u>		<u>5/9</u>		<u>5/12</u>		<u>5/14</u>
LCF	4.19	check	5.19	LCF	5.25	base	1.69
base	3.69	LCF	4.81	base	3.44	LCF	1.69
check	3.50	base	4.30	check	1.75	check	0.94
Trt	date	Trt	date	Trt	Total fruit weight		
	<u>5/16</u>		<u>5/19</u>				
LCF	1.44	LCF	2.31	LCf	46.69 a		
base	0.56	base	2.06	base	37.81 ab		
check	0.06	check	1.38	check	29.88 b		

LCF trial on tomato at HARC Kunia

Table 5. analysis of variance of root knot rating and of rating for numbers of secondary roots.

LSD (T) Comparison of means of **root knot rating by treatment**

HOMOGENEOUS		
TRT	MEAN	GROUPS
Base	16.500	I
check	14.750	II
LCF	13.000	..I

LSD (T) Comparison of means of **root knot rating by rep**

HOMOGENEOUS		
REP	MEAN	GROUPS
4	19.000	I
1	16.667	I
3	11.667	..I
2	11.667	..I

THERE ARE 2 GROUPS IN WHICH THE MEANS ARE NOT SIGNIFICANTLY DIFFERENT FROM ONE ANOTHER.
 CRITICAL T VALUE 2.447 REJECTION LEVEL 0.050
 CRITICAL VALUE FOR COMPARISON 3.2112
 STANDARD ERROR FOR COMPARISON 1.3123
 ERROR TERM USED: TRT*REP, 6 DF

LSD (T) Comparison of means of **secondary root number rating by treatment**

HOMOGENEOUS		
TRT	MEAN	GROUPS
Base	14.500	I
check	13.250	I
LCF	11.500	I

LSD (T) Comparison of means of **secondary root number by rep**

HOMOGENEOUS		
REP	MEAN	GROUPS
4	17.667	I
1	13.667	..I
3	11.667	..II
2	9.3333I

THERE ARE 3 GROUPS IN WHICH THE MEANS ARE NOT SIGNIFICANTLY DIFFERENT FROM ONE ANOTHER.
 CRITICAL T VALUE 2.447 REJECTION LEVEL 0.050
 CRITICAL VALUE FOR COMPARISON 3.6930
 STANDARD ERROR FOR COMPARISON 1.5092
 ERROR TERM USED: TRT*REP, 6 DF

Table 5 continued

LSD (T) Comparison of means of **total fruit number harvested by replicate plots.**

REP	HOMOGENEOUS MEAN	GROUPS
3	139.67	I
2	112.33	II
4	89.667	II
1	80.000	..I

THERE ARE 2 GROUPS IN WHICH THE MEANS ARE
NOT SIGNIFICANTLY DIFFERENT FROM ONE ANOTHER.
CRITICAL T VALUE 2.447 REJECTION LEVEL 0.050
CRITICAL VALUE FOR COMPARISON 59.109
STANDARD ERROR FOR COMPARISON 24.157