



FACT SHEET

Influence of Deep Soil Mixing and Tile Drainage on the Growth and Production of Gala Apples

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Introduction:

An on-farm trial was initiated in 1997 by Brad Spicer of Somerset, Nova Scotia to investigate the benefits of deep soil mixing and tile drainage on the productivity of Gala apples. The orchard site was cleared from woods and has a soil classification of Falmouth 52 (*Soils of the Annapolis Valley Area of Nova Scotia*). This class of soil is a moderately well drained soil with a depth to the constricting layer of 52 to 95 cm. The producer had noted poor tree growth in a section of this site, previously planted with fruit trees in the early 1990s, which he attributed to imperfect soil drainage. Standing water had been observed in section of the site during prolonged wet periods.

Materials and Methods:

Soil samples from across the site were collected from two levels, 0-15 cm and 15-30 cm, for nutrient analysis. Four tile drainage lines were installed at a depth of 1 m in the tree row; these drained one half of the site. Based upon the nutrient analysis, limestone, potash and phosphorous were applied to the soil surface over the full site prior to site preparation. In mid-August, one half of the site was deep plowed with a set of 78 cm disk ploughs, custom supplied by Sawler's Garden Ltd. Two passes were made with the disks, which mixed the soil to a depth of 50 cm. Soil mixing occurred over two of the four tile lines. A soil sample from the top 15 cm was collected following soil mixing, and analyzed. Additional limestone, potash and phosphorous was added to this section of the site based on the results of the soil analysis. The remainder of the site was prepared in the traditional manner with a plow and disk where soil mixing only occurs in the top 15 to 25 cm. This section of the site only had the single fertilizer application.

One-year-old Gala/EM 7a whips were planted in the spring of 1998 at a spacing of 2.7 by 4.8 meters for a tree density of 748 trees per hectare. Each tree is supported by a 2.4 meter pressure treated stake. General horticultural practices to promote tree growth and good fruiting structure were carried out by the producer. Three replicates of five trees were marked out for the three treatments: tile drainage, tile drainage plus soil mixing and soil mixing and the control. The control was soil that was not drained or deep ploughed but prepared in the traditional manner for fruit trees. Yield, fruit grade out and trunk diameter have been recorded on an annual basis. Trunk diameter measurements were taken at 30 cm above the graft union using electronic calipers. Total weight of pick and drops was recorded on a per tree bases. A 50 apple sample was collected from the three replicates and graded according to fruit diameter.

Results:

Yields for the first two years of cropping are given in Table 1. With the exception of the tiled drained treatment, the yields in 2001 were smaller than those of 2000. The reduced yield is attributed to a poor set and not lack of return bloom. Yields from the three treatments were higher than the control in both years.

To date the highest accumulated yield has occurred for the deep plowed plus tile drained treatment where there has been a 128 percent increase in yield over the control. Tile drainage under the tree has resulted in the second highest accumulated yield with a 96% increase in yield. Deep plowing was not as effective as tile drainage but yields were still 32 percent higher than the control.

Table 1: Soil Treatment Effects On Average Yield Per Tree, And Average Fruit Weight

Treatment	Yield per Tree Kg		Yield per Acre Bu		Accumulated Yield 2000-2001
	2000	2001	2000	2001	
Control	7.44	5.34	119	85.16	204.16
Tiled	11.85	13.25	189	211.30	400.3
Deep Plowed	11.37	7.50	181	119.61	300.6
Deep Plowed + Tiled	16.55	12.63	264	201.41	465.41

The average fruit size for all treatments (Table 2) was greater than 2 3/8" with 82 to 95 percent of the fruit greater than 2 3/4" for all treatments. The deep plowed plus tiled had the highest percentage of fruit in the 2 1/2" to 2 3/4" size range followed by the control. The average grade for all four treatments was a 113 count.

Table 2 Percentage of apples in four grade sizes and average fruit weight

Treatment	<2 3/8"	2 3/8-2 1/2"	2 1/2-2 3/4"	2 3/4 ">	Average Fruit Weight gm
	%	%	%	%	
Control	0	0	11.06	88.97	171.78
Tiled	0	0	5.06	94.93	175.75
Deep Plowed	0	0	4.41	95.95	169.78
Deep Plowed + Tiled	0	1.27	16.08	82.65	178.28

The greatest increase in trunk diameters (Table 3) has been recorded for the deep plowed plus tiled treated followed by the tiled treatment. The control trees have had the smallest increase in diameter over the four growing seasons.

Table 3 Trunk diameter measurements in mm.

Treatment	June 1998	May 1999	May 2000	Oct 2000	Oct 2001	Increase from 1998
Control	12.23	21.84	35.19	47.29	60.20	47.97
Tiled	11.87	21.38	37.25	49.12	61.14	49.27
Deep Plowed	11.77	21.96	36.22	49.01	60.41	48.64
Deep Plowed + Tiled	11.69	21.16	38.35	51.17	63.83	52.14

Conclusion:

It is too early to draw conclusions with regards to the full impact of the three soil modification treatments on the productivity and growth of the Royal Gala trees. The increase in yields for the tree treatments indicated that the treatments are having a positive effect on productivity and it would appear that drainage was more beneficial than soil mixing but there is also an indication that mixing along with drainage had the greatest impact. It will take several more years of cropping before these assumptions can be verified. Fruit size was similar for all treatments and the yield on a per tree basis is be consider to be light. The trees are still in a vegetative stage and have not settle down into full production.

For more information, contact:

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