# 2011 VERMONT ORGANIC CORN SILAGE PERFORMANCE TRIALS

In 2011, the University of Vermont Extension conducted a short season organic corn silage variety trial in cooperation with Vermont Technical College (VTC) in Randolph, Vermont. The purpose of the study was to provide unbiased performance comparisons of commercially available organic silage corn varieties. It is important to remember, however, that the data presented are from replicated research trials from only one location in Vermont and represent only one season. Crop performance data from additional tests in different locations and over several years should be compared before making varietal selections.

## MATERIALS AND METHODS

In 2011, an organic corn silage performance trial was conducted at Vermont Technical College in Randolph, VT. All fields were certified organic by Vermont Organic Farmers, LLC. Several seed companies and farmers submitted varieties for evaluation (Table 1). The organic corn grown at the Randolph site was considered early maturing corn (75-95 RM), based on the Relative Maturities provided by the companies. The specific varieties and their RMs are listed in Table 2.

**Table 1. Participating companies and local contact information.**

| Albert Lea Seed | American Organic | Blue River Hybrids Organic Seed |
|---|---|---|
| 1414 West Main Street<br>PO Box 127<br>Albert Lea, MN 56007<br>(800) 352-5247 | Art Scheele<br>PO Box 385<br>Warren, IL 61087<br>(866) 471-9465 | Boucher Fertilizer<br>2343 Gore Road<br>Highgate Center, VT<br>(802) 868-3939 |
| **Butterworks Farm** | **Lakeview Organic Grain** | |
| Jack Lazor<br>421 Trumpass Rd<br>Westfield, VT 05874<br>(802) 744-6855 | Klaas & Mary-Howell Martens<br>Box 361<br>Penn Yan, NY 14527<br>(315) 531-1038 | |

**Table 2. Organic corn varieties evaluated in Randolph, Vermont, 2011.**

| Company | Variety | RM | Description |
|---|---|---|---|
| Albert Lea Seed Co, Viking Corn, MN | E-95 | 95 | Open Pollinated |
| Albert Lea Seed Co, Viking Corn, MN | 0.23-86N | 86 | Hybrid |
| Albert Lea Seed Co, Viking Corn, MN | 80-92 | 92 | Hybrid |
| Albert Lea Seed Co, Viking Corn, MN | 0.99-90N | 90 | Hybrid |
| American Organic Seed & Grain, IL | B916 | 85-87 | Hybrid |
| American Organic Seed & Grain, IL | C714 | 93-95 | Hybrid |
| American Organic Seed & Grain, IL | VP2P58 | 84 | Hybrid |
| American Organic Seed & Grain, IL | VP3P26 | 89 | Hybrid |
| Blue River Hybrids, IA | O8T91 | 78 | Hybrid |
| Blue River Hybrids, IA | 19K19 | 83 | Hybrid |
| Blue River Hybrids, IA | 26A17 | 88 | Hybrid |
| Blue River Hybrids, IA | O8N01 | 78 | Hybrid |
| Blue River Hybrids, IA | BR23L99 | 86 | Hybrid |
| Butterworks Farm, VT | Early Riser | 80 | Open Pollinated |

The previous crop at the Randolph site was wheat. The soil was a silt loam. The seedbed was prepared by conventional tillage methods and planted with a John Deere 7000 four-row corn planter on 2-Jun. Each plot was 5'x50', with two 30-inch wide rows. 8000 gal/acre of manure was applied to the site in the spring. The plots were hand-weeded July 6. The plots were later hand-harvested with machetes. From each plot, two 17.5' row sections were harvested and weighed with small platform scales. The subsample was then chopped with a Troy-Bilt chipper shredder. After mixing, a subsample of chopped corn was dried and analyzed for forage quality by the Cumberland Valley Forage Laboratory in Maryland. Pertinent trial information is summarized in Table 3.

**Table 3. Organic silage corn variety trial information, Randolph, Vermont, 2011.**

| Trial Information | |
|---|---|
| Soil type | Silt loam |
| Previous crop | Wheat |
| Row width (in) | 30 |
| Plot size | 5'x50' |
| Planting date | 2-Jun |
| Row cultivation | 1-Jul |
| Seeding rate (seeds/acre) | 34,000 |
| Tillage operations | Spring plow, spring disk |
| Manure application | Spring applied - 8000 gal/acre |
| Additional weed control | Hand-weeded on 6-Jul |
| Harvest date | 4-Oct |

Silage quality was analyzed using wet chemistry techniques at the Cumberland Valley Forage Laboratory in Pennsylvania. Plot samples were dried, ground and analyzed for crude protein (CP), acid detergent fiber (ADF), neutral detergent fiber (NDF), and 30h digestible NDF (dNDF). Mixtures of true proteins, composed of amino acids, and nonprotein nitrogen make up the CP content of forages. The CP content of forages is determined by measuring the amount of N and multiplying by 6.25. The bulky characteristics of forage come from fiber. Forage feeding values are negatively associated with fiber since the less digestible portions of plants are contained in the fiber fraction. The detergent fiber analysis system separates forages into two parts: cell contents, which include sugars, starches, proteins, nonprotein nitrogen, fats and other highly digestible compounds; and the less digestible components found in the fiber fraction. The total fiber content of forage is contained in the neutral detergent fiber (NDF). Chemically, this fraction includes cellulose, hemicellulose, and lignin. Because of these chemical components and their association with the bulkiness of feeds, NDF is closely related to feed intake and rumen fill in cows. Recently, forage testing laboratories have begun to evaluate forages for NDF digestibility. Evaluation of forages and other feedstuffs for NDF digestibility is being conducted to aid prediction of feed energy content and animal performance. Research has demonstrated that lactating dairy cows will eat more dry matter and produce more milk when fed forages with optimum NDF digestibility. Forages with increased NDF digestibility will result in higher energy values, and perhaps more importantly, increased forage intakes. Forage NDF digestibility can range from 20 – 80%.

The silage performance indices of milk per acre and milk per ton were calculated using a model derived from the spreadsheet entitled, “MILK2007” developed by researchers at the University of Wisconsin. Milk per ton measures the pounds of milk that could be produced from a ton of silage. This value is generated by approximating a balanced ration meeting animal energy, protein, and fiber needs based on silage quality. The value is based on a standard cow weight and level of milk production. Milk per acre is calculated by multiplying the milk per ton value by silage dry matter yield. Therefore milk per ton is an overall indicator of forage quality and milk per acre an indicator of forage yield and quality. Milk per ton and milk per acre calculations provide relative rankings of forage samples, but should not be considered as predictive of actual milk responses in specific situations for the following reasons:

1) Equations and calculations are simplified to reduce inputs for ease of use.

2) Farm to farm differences exists.
3) Genetic, dietary, and environmental differences affecting feed utilization are not considered.

Variations in yield and quality can occur because of variations in genetics, soil, weather, and other growing conditions. Statistical analysis makes it possible to determine, whether a difference among varieties is real or whether it might have occurred due to other variations in the field. At the bottom of each table a LSD value is presented for each variable (i.e. yield). Least Significant Differences (LSD's) at the 10% level of probability are shown. Where the difference between two varieties within a column is equal to or greater than the LSD value at the bottom of the column, you can be sure in 9 out of 10 chances that there is a real difference between the two varieties. Varieties that were not significantly lower in performance than the highest hybrid in a particular column are indicated with an asterisk. In the example below, A is significantly different from C but not from B. The difference between A and B is equal to 1.5 which is less than the LSD value of 2.0. This means that these varieties did not differ in yield. The difference between A and C is equal to 3.0 which is greater than the LSD value of 2.0. This means that the yields of these varieties were significantly different from one another. The asterisk indicates that B was not significantly lower than the top yielding variety.

| **Variety** | **Yield** |
|---|---|
| A | **9.0*** |
| B | 7.5* |
| C | 6.0 |
| **LSD** | **2.0** |

# RESULTS

Seasonal precipitation and temperature was recorded at weather stations in proximity to the Randolph VTC site (Table 4). This season brought a cold spring with higher than average rainfall during the normal corn planting season. The total accumulated Growing Degree Days (GDDs) for corn growth in Randolph, based on a 50° - 86° F temperature scale, was 2704 days. Thus, the accumulated GDD was above average by 615.

**Table 4. Summarized temperatures, precipitation, and growing degree days, Randolph, Vermont, 2011.**

| Bethel, VT (Randolph) | April | May | June | July | August | September | October |
|---|---|---|---|---|---|---|---|
| Average Temperature (°F) | 42.1 | 58.2 | 64.0 | 70.7 | 67.2 | 62.2 | 49.0 |
| Departure from Normal | 0.2 | 2.0 | 2.7 | 4.7 | 3.6 | 5.6 | -3.0 |
| | | | | | | | |
| Precipitation (inches) | 5.75 | 4.22 | 6.95 | 3.12 | 11.05 | 9.21 | 2.97 |
| Departure from Normal | 2.39 | 0.59 | 3.31 | -0.84 | 5.91 | 4.75 | 0.36 |
| | | | | | | | |
| Growing Degree Days (base 50°F) | 39.0 | 311 | 422 | 623 | 525 | 474 | 311 |
| Departure from Normal | -66.0 | -4.2 | -22.5 | 28.9 | -8.0 | 162 | 163 |

*Temperatures and precipitation are from Rochester, Vermont for the months August-September.
*Temperature and precipitation for October are from Rutland, Vermont.
*Based on National Weather Service data from cooperative observation stations in close proximity to field trials. Historical averages are for 30 years of data (1971-2000).

Yield and quality results are listed in Table 5. Dry matter yields were calculated and then adjusted to 35% dry matter. As seen in Table 5, there were not any significant differences between varieties for CP, ADF, or dNDF. However, there were significant differences between varieties for NDF and NEL. The variety 19K19 (Blue River) had the lowest NDF concentration at 40.2% but was not statistically different from 08T91 (Blue River), 26A17 (Blue River), B916 (American Organic), VP3P26 (American Organic), 80-92 (Viking), and 023-86N (Viking). NEL ranged from 0.70 to 0.77 Mcal/lb. The variety with the highest NEL was the 80-92 (Viking) at 0.77 Mcal/lb. Only VP2P58 (American Organic), BR23L99 (Blue River), Early Riser (Butterworks), and E-95 (Viking) were statistically lower.

Also in Table 5, it can be seen that the population ranged from 15931 plants per acre to 28127 plants per acre. The recommended final plant population for corn silage is 32,000 to 34,000 plants per acre. Obviously the trial fell well below that plant population. Low plant populations would have led to potential yield loss. It is difficult to accurately compare varieties with the popu1ations differing so greatly among them. Interestingly, population did not seem to always be the major driver for low yields (Figure 2).

As seen in Figure 1, yields varied significantly by variety. Yields ranged from 9.2 to 22.1 tons per acre. The variety 23L99 (Blue River) yielded the highest at 22.1 tons/acre and was not statistically different than VP2P58 (American Organic), 26A17 (Blue River), and 80-92 (Viking)

**Table 5. Silage yield and quality of organic short season corn varieties, Randolph, Vermont.**

| Company | Variety | Relative maturity | Moisture at harvest | Population per acre | Yield at 35% DM | Forage quality characteristics | | | | | Milk per | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | CP | ADF | NDF | dNDF | NEL | ton | acre |
| | | days | % | | ton/acre | % | % | % | % | Mcal/lb | lbs | lbs |
| Amer. Org. | B916 | 85-87 | 67.3 | 20909 | 9.2 | 7.4 | 27.1 | 46.2* | 50.3 | 0.74* | 2550 | 8286 |
| Amer. Org. | C714 | 93-95 | 68.8 | 25140* | 13.2 | 6.9 | 28.1 | 49.4 | **62.3** | 0.74* | 2853 | 13188 |
| Amer. Org. | VP2P58 | 84 | 66.6 | 22402 | 18.9* | 7.7 | 29.1 | 48.6 | 57.8 | 0.74 | 2713 | 17966 |
| Amer. Org. | VP3P26 | 89 | 64.7 | 25638* | 16.1 | 7.5 | 24.5 | 42.5* | 58.6 | 0.77* | **2869** | 16181 |
| Blue River | 08N01 | 78 | 66.5 | 21407 | 14.4 | 7.4 | 27.7 | 47.0 | 55.7 | 0.74* | 2714 | 13600 |
| Blue River | 08T91 | 78 | 66.0 | 20162 | 13.8 | 7.5 | 26.6 | 46.2* | 57.4 | 0.75* | 2736 | 13098 |
| Blue River | 19K19 | 83 | 68.0 | **28127*** | 16.0 | 7.8 | **23.7** | **40.2*** | 54.4 | 0.76* | 2675 | 25196 |
| Blue River | 26A17 | 88 | 66.0 | 26136* | 19.6* | 6.8 | 27.1 | 46.3* | 56.5 | 0.74* | 2677 | 18409 |
| Blue River | BR23L99 | 86 | 62.0 | 25931* | **22.1*** | **8.8** | 27.2 | 47.5 | 57.3 | 0.74 | 2774 | **35659*** |
| Butterworks | Early Riser | 80 | 61.2 | 23398 | 17.0 | 7.6 | 28.4 | 49.0 | 51.7 | 0.73 | 2519 | 15047 |
| Viking Org. | 80-92 | 92 | 68.0 | 24891* | 21.0* | 7.4 | 24.1 | 42.2* | 55.5 | **0.77*** | 2827 | 20748 |
| Viking Org. | E-95 | 95 | **71.6*** | 26385* | 16.5 | 7.3 | 31.9 | 55.6 | 57.0 | 0.70 | 2502 | 14326 |
| Viking Org. | O23-86N | 86 | 63.6 | 25389* | 17.6 | 8.1 | 25.9 | 45.5* | 56.2 | 0.74* | 2788 | 17200 |
| Viking Org. | O99-90N | 90 | 66.3 | 21656 | 12.1 | 7.5 | 27.2 | 47.2 | 48.9 | 0.75* | 2510 | 10642 |
| LSD (0.10) | | | 2.05 | 4592 | 3.91 | NS | NS | 6.12 | NS | 0.03 | NS | 9566 |
| Trial Mean | | | 66.2 | 23401 | 16.3 | 7.5 | 27.0 | 46.6 | 55.7 | 0.74 | 2693 | 17110 |

*Treatments indicated with an asterisk did not perform significantly lower than the top-performing treatment in a particular column.
**B** Treatments shown in bold are of the highest value or top performing
NS – No significant difference was determined between treatments.

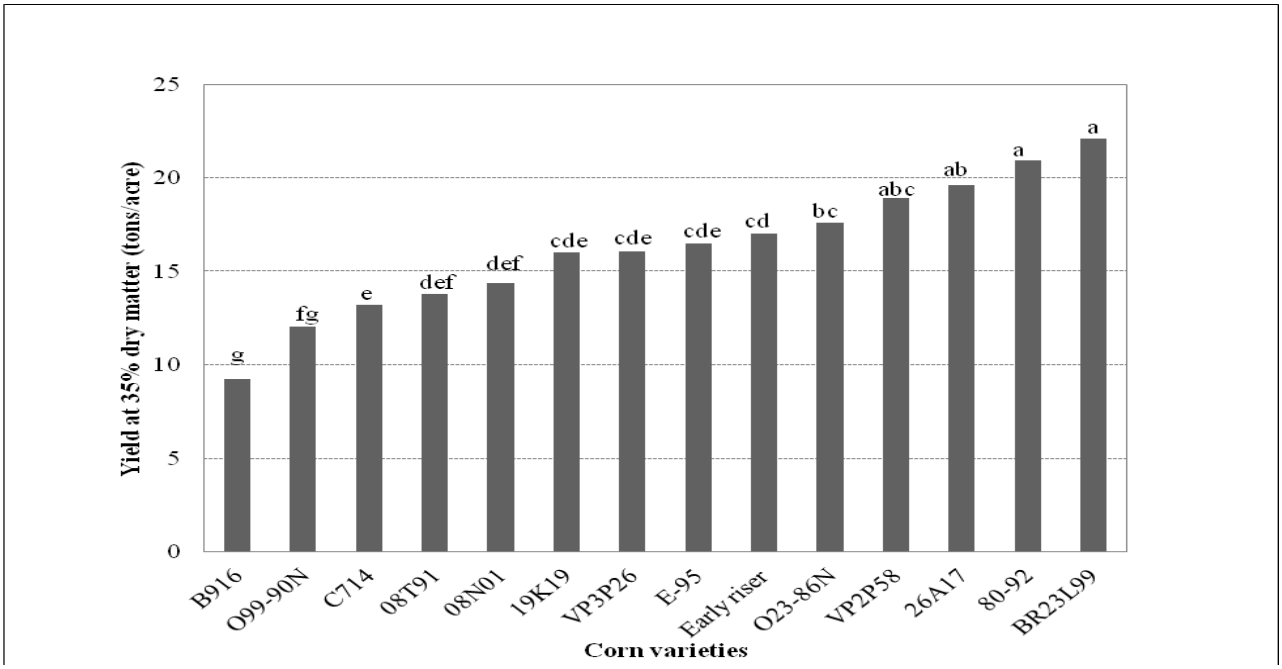


**Figure 1. Corn silage yield of short season organic corn varieties, Randolph, Vermont.** ***Varieties with the same letter did not differ significantly in yield.***

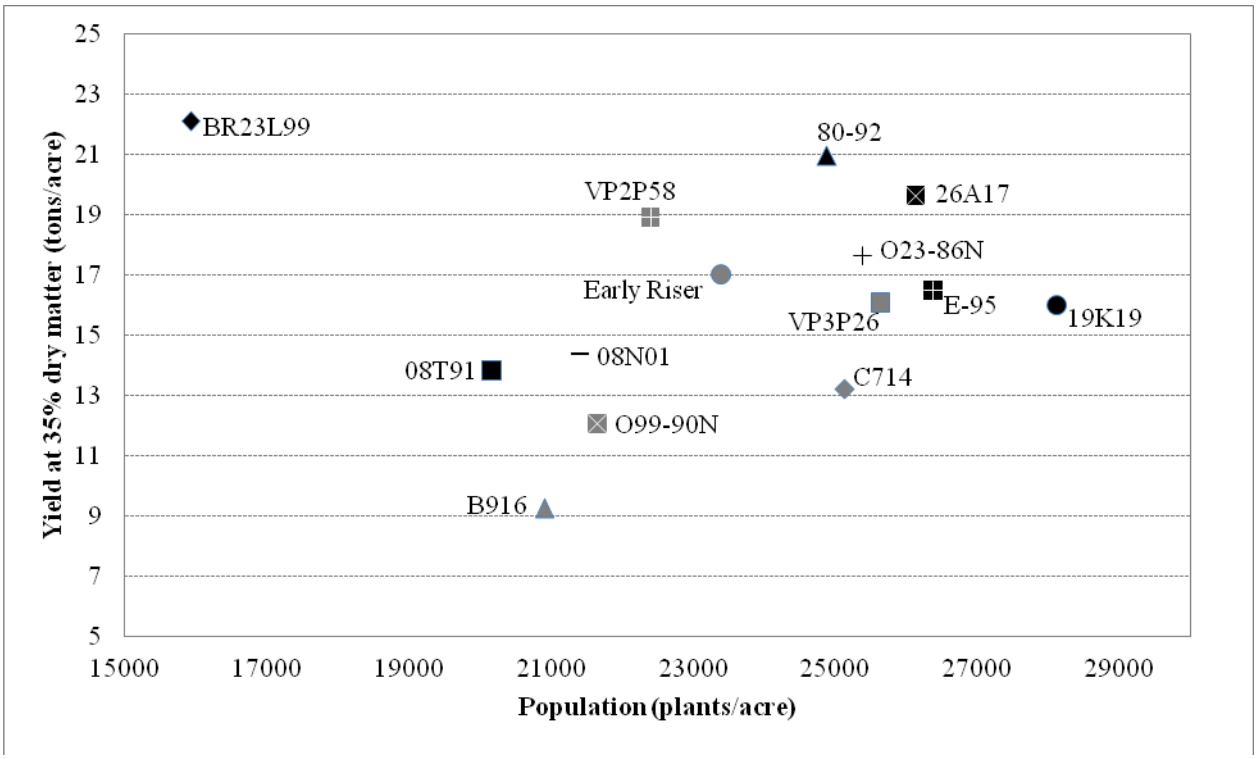


**Figure 2. Comparison of population and yield for organic corn silage varieties, Randolph, Vermont.**

Figure 3 displays the relationship between milk per ton and milk per acre. The dotted lines dividing the figure into four quadrants represent the mean milk per ton and acre for the location. Therefore hybrids that fall above the lines performed higher than the average and hybrids below the lines performed below average. Milk per ton measures the pounds of milk that could theoretically be produced from one ton of silage. Milk per acre is calculated by multiplying the milk per ton value by silage dry matter yield. Thus milk per ton is an overall indicator of forage quality and milk per acre is an indicator of forage yield and quality. Shown in Figure 3 is a comparison of how each variety ranked in terms of milk per ton and milk per acre. BR23L99 (Blue River), VP2P5 (American Organic), 023-86N, and 80-92 all had above average yields and quality.

## DISCUSSION

This was the third year for the UVM Extension organic corn variety trial. The chilly, wet spring resulted in cool soils that potentially impacted germination rates in untreated organic seeds. Overall the trial had an average 61% emergence rate. Low germination rates may indicate a need to plant at higher seeding rates or delay planting to improve soil conditions. Approved organic seed treatments may be another option to increase germination rate, however little data has been collected on efficacy. In late August, there was a tropical storm with up to 70 mph winds, which also caused lodging and lowered the quality and yields of the corn crop.

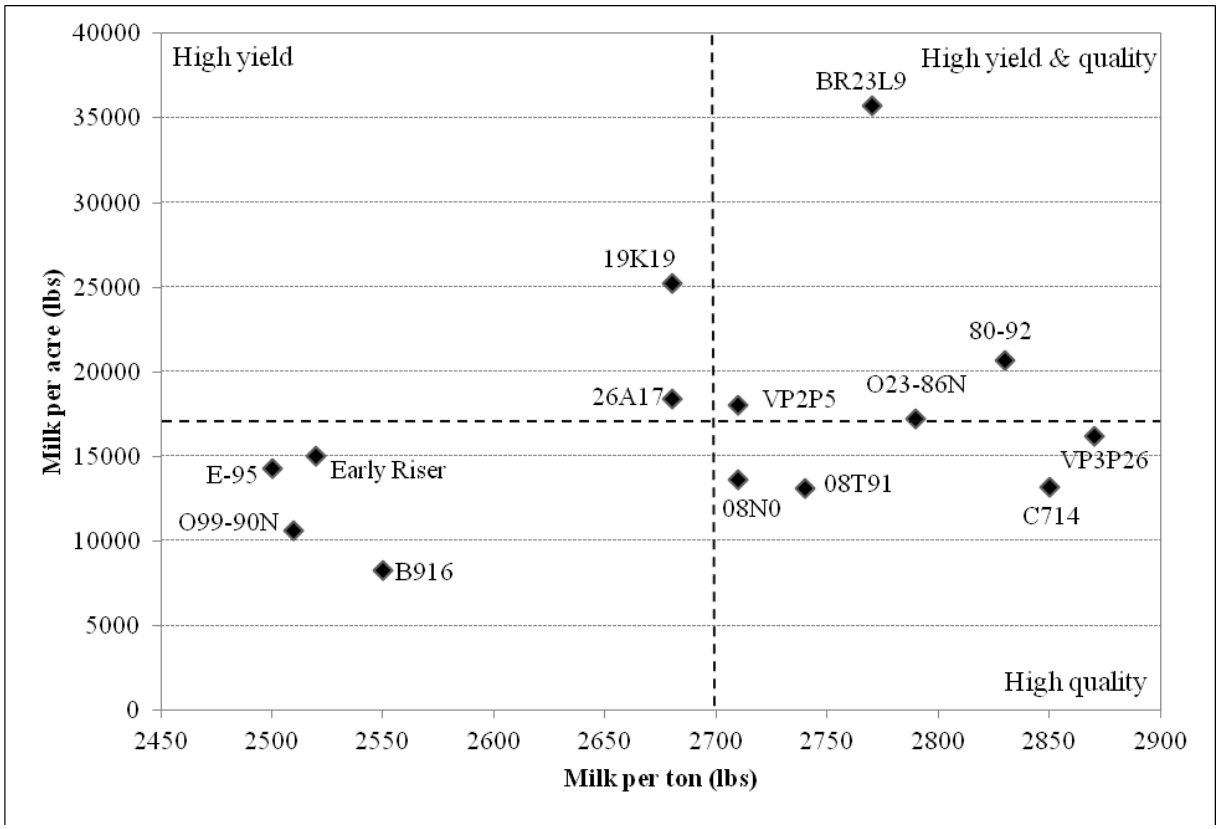


**Figure 3. Milk performance of organic corn silage varieties, Randolph, Vermont.** ***Dotted lines indicate overall average of milk per ton and milk per acre.***

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