**Project Title: Fountain Creek Dry Bean Project**

Submitted by: Susan Gordon, Venetucci Farm

**I Project Summary:** Small produce farmers are in need of income sources during the off season. Organic produce growers supply to a niche market comprised of consumers committed to buying locally grown, organic produce. These customers are looking to purchase locally grown produce year round, yet there are limited Colorado grown specialty crops available in the off season. Organically grown dry beans are a crop that could be grown and stored to meet this off-season demand. Two farms, Venetucci Farm and Frost Family Farm, participated in this project designed to identify best practices for growing dry beans organically on a small scale. Both farms practice sustainable farming methods and grow and sell diverse vegetables in both retail and wholesale markets in the Pikes Peak region. Early in the project a survey was distributed to CSA members to determine customer demand and potential for niche market. Five different varieties of dry beans, selected for their growing habits and re-sale potential, were grown. Three of the varieties were heirloom and two were not. The objective of the project was to identify best varieties as well as best cultural practices for growing, cultivating, and harvesting dry beans for small scale production and sales.

**II Project Approach**

A. **Survey:** A Survey was conducted at the onset of our project to gauge demand and willingness to pay more for locally grown, organic dry beans. The majority of respondents (60%) indicated they consume between 10 and 20 pounds of dry beans per year, with 25% of those eating over 20 pounds annually. The primary reasons identified for consuming beans were the taste and the protein. The majority of respondents chose black turtle when offered the choice of the 5 varieties trialed, with Vermont cranberry as second most popular choice. When asked what variables they consider when purchasing beans, respondents indicated that organic, Colorado-grown, and price were the 3 most important variables, with 52% saying they would be willing to pay up to $3.49 for locally-grown, organic beans.

Variety Selection: Initially the plan was to grow six different varieties, but after some research and consultation with our technical advisor, we reduced the number to 5 and chose only varieties that had bush growth habits. Although advised to stay away from land race, heirloom varieties because of their unpredictable yields and poor marketability, the results from our survey indicated there was a demand among our customers.

B. **Cultural Practices:**

1. **Planting:** The fields that were to be furrow irrigated and planted in Black Turtle, Pinto, Jacob’s Cattle, and Red Kidney were disked, leveled, and furrowed creating 36” on center beds, which were then planted in a single row of beans using a tractor pulled Planet Junior at 6-8 inch spacing. The Vermont Cranberry beans were planted in 3 foot raised beds created by a bed maker implement pulled by a tractor. Two lines of drip tape were laid 10” apart. The beans were planted on the outside of the tapes
using a two row Planet Jr mounted on a Allis Chalmers G, two rows per bed, at a high density, 2-4” spacing. An attempt was also made to trial pinto beans without irrigation, but they did not germinate until 60 days after planting, 3 days after a heavy rain, so they were abandoned.

2. Irrigation: The furrow irrigated beans were watered every 14-20 days. The beans on drip tape were irrigated every 10-12 days for approximately 2 hours each time. Hot, dry weather early in the growing season necessitated regular irrigation. Unusually heavy rains in August and September meant less irrigation and more weeds.

3. Cultivation: Controlling weed pressure was one of the greatest challenges. A liliston cultivator was used with great success to clear the weeds in the furrows and on the edges of the beds of the furrow irrigated beans. This method of cultivation needed to be done five times throughout the growing season to keep the weeds between the bean rows in check. The vining growth habit of the pinto beans only allowed for it to happen twice. The beans planted on drip tape were also only mechanically cultivated twice with cultivating shovels attached to an Allis Chalmers G. The bind weed made it impossible to do it more as the plants would have been pulled with the weed. Many hours of hand weeding and hoeing were required to control the weeds in all the bean fields. An attempt was made to hoe and/or hand weed the beans every 10 days. This was not always possible given the other demands on a small diversified farm. Unfortunately, 4 of the 8 black turtle rows were lost to weeds due to inability to cultivate with the liliston at the right time and/or to devote sufficient human labor to the weeding task.

4. Harvesting: Heavy fall rains created harvesting challenges and resulted in some fungus problems in the more densely planted Vermont Cranberry beans planted on the drip tape. We were unable to access a bean cutter and had to pull the plants by hand, pile them on tarps, and store them in a dry, protected space to finish drying. The weed pressure made harvesting of the plants difficult and labor intensive. One of the farms had access to a large group of volunteers for this step.

5. Threshing: We borrowed a portable thresher from the Rocky Ford Extension Office to do the threshing. It is designed to be pulled through the field along the windrows of dried beans while the plants are fed into it. In theory this seemed like a good idea and would have eliminated the need to transport the beans to a protected storage space, but the weather this fall made this approach impossible. Also, other demands at the time this should have happened made it impossible so it worked better to get the bean plants out of the field and store them until they could be threshed. The black beans were threshed by hand by hundreds of school children visiting the farm for the annual pumpkin give away. The bean plants were set up as one of the educational stations that the children visit in small groups when they come to the fall in early October. It made for a fun and valuable educational activity and allowed us to get the work done. This would only be practical for farms that have an education component to their mission or have the opportunity to recruit a crop mob. After both the mechanical threshing and hand threshing, the beans are still not clean enough for the market. Some additional piece
of cleaning equipment is needed to make the beans market-ready. We will probably attempt to winnow them by pouring them in front of a big fan sometime this winter.

C. Furrow vs Drip Irrigation: One of the goals of this project was to evaluate these two irrigation methods. Given the unusually high level of precipitation we received this past season, it is difficult to adequately access this component. Laying drip tape by hand is labor and time intensive. The grant did allow for the purchase of a bedder/drip tape layer, which significantly reduced the time and labor involved in this step. The beans irrigated with drip had better germination, and consequently required hand thinning, but the need for thinning could be eliminated with more carefully spaced planting. Using drip irrigation is less labor intensive as it requires less management than flood furrow irrigation. In a normal rainfall year it also results in fewer weeds. Although drip uses less water and takes less time to manage once it is set up, it requires an annual monetary investment in drip tape and produces waste at the end of the season.

D. Pests and Disease: With the exception of the Mexican bean beetle, which damaged the Vermont Cranberry, we had minimal pest pressure. No signs of disease were evident except with the Vermont Cranberry, which developed fungus as a result of the heavy rainfall and the dense planting, which inhibited air flow.

III Goals and Outcomes Achieved (see attachment A)

IV Beneficiaries – The beneficiaries of this project are small, organic specialty crops growers engaged in direct market sales and consumers committed to buying locally grown, organic food.

V Lessons Learned

1. Variety selection: It is important for the purpose of mechanical cultivation that bush type varieties be selected for commercial production. According to our survey results, black turtle beans would have good marketability. Black Turtle beans also germinated well, had an upright growth habit with decent yield, and suffered minimal pod shatter. Pintos had the best yield but the particular cultivar planted, which were identified as bush type by the source, were more viney than the other varieties, making mechanical cultivation impossible after a month of growth. They were also not identified as a favorite among those surveyed. It would be worth trying the Vermont Cranberry again, paying closer attention to proper plant spacing.

2. Planting: The Planet Jr worked well for planting. Planting two rows at a time would be more efficient, but would require a longer bar on the Allis Chalmers G to accommodate two rows at 36" row spacing. It is also important to use the correct plate determined by the size of the seed so that there is adequate spacing between plants. We lost a significant amount of Vermont Cranberry beans to fungus because they were not adequately thinned after being planted too densely and we received heavy rains in August and again in September.

3. Cultivation: The single row beans planted with furrows were mechanically cultivated with a tractor pulled lister. The double row planted beans on drip tape were cultivated with shovels mounted on a Allis Chalmers G. Both worked relatively well but did not eliminate the need for
many hours of hoeing and hand weeding between the plants. It is important to mechanically cultivate early and regularly between the rows to reduce weed impact. It is also important to choose a field that is free of bind weed. Four of the eight rows of black turtle beans were abandoned because the weeds out competed the plants, severely inhibiting their growth. Heavy rains in August made timely mechanical cultivation challenging and necessitated many hours of hand weeding, which was not always possible given limited labor resources and conflicting demands on the farm. If possible, it would be a good idea to schedule crop mobs, or large groups of volunteers, to assist with the hand weeding. This is a feasible option for farms located near and connected with urban centers. Hand weeding is necessary in addition to the mechanical cultivation in order to keep the weeds between the plants in check, especially early in the season. Frost farms attempted to hoe the .76 acres of bean rows with staff every 10 days for a total of 406 hours. Venetucci farm used a combination of paid staff and volunteers to hand weed the .35 acres for approximately 100 hours. Farmers should avoid growing dry beans in fields known to have a bind weed problem.

4. Irrigation: A failed attempt was made to grow a small amount of pinto beans without irrigation. After irrigating only once prior to planting, the beans were not irrigated again. We had very low rainfall early in the season and consequently it took 60 days for the control non-irrigated pinto beans to germinate. They were subsequently abandoned due to the late germination date. Before the heavy rains in August, the flood furrow irrigated beans were irrigated every 14-20 days. The beans on drip were irrigated for 2 hours every 10-14 days. Due to the unusually wet periods late in the growing season, it is difficult to accurately compare and assess the two different irrigation methods. Drip irrigation in general uses water more efficiently and results in fewer weeds because the water is emitted directly to the base of the plant. Each method has its pros and cons. One of the cons of the drip system is the upfront set up time, which is significantly reduced with the drip tape layer implement. The greatest pros of the drip system are that it involves far less management time and it is a far more efficient use of water than flood furrow. The greatest downsides are the financial outlay to purchase the drip tape, and the waste produced at the end as the drip tape is often only good for one season unless great care can be taken to ensure no punctures while in the field or in storage, in which case the tape may be good for two seasons. The time saved managing the drip tape (10 minutes vs 6-18 hrs, depending on row length) compensates for the initial set up costs involved in the drip irrigation method. This farmer, because I now have access to a drip tape layer and the infrastructure for drip irrigation, would choose drip over flood furrow for dry bean production because of the time and water savings.

5. Harvesting: Unfortunately, because we did not have access to a working bean cutter, all the plants were pulled by hand. Two unsuccessful attempts were made to mechanically harvest the beans, one with wide sweeps and the other with a potato digger. Neither was satisfactory. The farm located near the urban center once again employed volunteers to pull the plants. It took fifteen volunteers 4 hours to pull all the plants and pile them on tarps. The .76 acres of beans at Frost Farm required a total of 131 person hours to pull all the plants. Late season rainfall
complicated and lengthened the harvesting and drying period. The harvest of two-thirds of the Frost crop had to be postponed because of fall rains. This resulted in some loss from pod shatter once the plants still in the field dried after the rains. Also, because of the rains, the harvested plants could not be left in the field to finish drying and needed to be moved out of the field to sheltered space, which added time to the harvesting phase.

6. Threshing: This step presents additional challenges for the small grower. A large amount of dry beans cannot be efficiently threshed and cleaned without a threshing machine. We borrowed a portable thresher from the Rocky Mountain field station but were dissatisfied with the results. Too many of the beans were cracked when the machine was used and too much debris was still left after threshing. A less efficient, but more reliable threshing process, may be threshing by hand. The bean plants can be wrapped in the tarp, stomped on to crack open the pods, and then winnowed by pouring them from one container into another in front of a fan. This method requires sufficient space and time and still does not result in a clean product. We still intend to explore the possibility of using the AVOG clipper to do a final cleaning of the beans.

7. Labor: This project turned out to be a very labor intensive project, which made the dry beans an expensive crop to produce. The Frost Farm data shows it took 1 man hour per every pound of bean produced or approximately 913 man hours per acre of beans. Without the proper machinery to efficiently cultivate, harvest, and thresh the beans, a small farmer could not afford to grow this specialty crop unless she/he had access to a lot of volunteer labor. There is the market demand for this crop, but consumers are not willing to pay what would need to be charged to cover the cost of labor ($9-$12/hour), not to mention other costs involved. Pintos, Kidneys, and Black Turtle would be good varieties to grow if the proper equipment could be procured.
### Attachment A.

<table>
<thead>
<tr>
<th></th>
<th>Vermont Cranberry</th>
<th>Black Turtle</th>
<th>Jacob's Cattle</th>
<th>Light Red Kidney</th>
<th>Pinto</th>
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<tbody>
<tr>
<td>Acres planted</td>
<td>0.14</td>
<td>0.21</td>
<td>0.39</td>
<td>0.33</td>
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<tr>
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<td>Jun-13</td>
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<td>Jun-13</td>
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<tr>
<td>Published maturity date</td>
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<td>100 days</td>
<td>90 days</td>
<td>85 days</td>
<td>100 days</td>
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<tr>
<td>Dates cultivated (mechanical)</td>
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<td>6/26, 8/7</td>
<td></td>
<td></td>
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<tr>
<td>Date harvested</td>
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<td>Oct-13</td>
<td>Sept 11, 23, 24</td>
<td>Sep-13</td>
<td>Sept 19, 20, 23</td>
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<td>Days planting to harvest</td>
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<td>125</td>
<td>101-114</td>
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<td>Weight - threshed but not cleaned</td>
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<td>237lbs</td>
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<td>TBD</td>
<td>613lbs</td>
<td>972lbs</td>
<td>1,637lbs</td>
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