AGRICULTURAL COMPETITIVENESS & ENTERPRISE DEVELOPMENT PROJECT

ASSESSMENT OF BERRY PRODUCTION POTENTIAL IN MOLDOVA

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# USAID Moldova – MCC Moldova
## AGROINTEGRAL COMPETITIVENESS AND ENTERPRISE DEVELOPMENT PROJECT

### ASSESSMENT OF BERRY PRODUCTION POTENTIAL IN MOLDOVA

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I. EXECUTIVE SUMMARY

Small fruit production (i.e. berry production), an exceptionally high-value crop enterprise, requiring intensive labor, with the ability to provide sustainable family incomes on relatively small area farms, has captured the attention of the development community in Europe. In the Republic of Georgia, after several years of USAID supported exploratory efforts, the first fledgling private farms to reclaim abandoned State tea plantation land shipped 60Tons of North American Highbush Blueberries to Western markets in 2013, and an additional 100 hectares of new blueberry plantation was established. Former small farm stakeholders of USAID small fruits development projects in Serbia banded together in Bajina Basta to form an association, built a small cold-storage facility, and this year sold their blueberry harvest to eager buyers in Germany for 6.00€/kg. In Kosovo, raspberry farmers are realizing that their traditional hand-harvested fruit-for-process is rapidly becoming non-competitive with machine harvested raspberries from larger consolidated farms in Serbia, Poland, the UK and other production areas in Europe. USAID’s NOA project is assisting these farmers to transition to new varieties suitable for fresh markets where they are realizing an 8 to10 fold increase in the prices they are paid.

Nations emerging from recent conflicts, failed economies, and political rearrangement in South-central and Eastern Europe have been crippled with shuttered industries, collapsed infrastructure, high unemployment, and low GDP. Rural communities in these regions are particularly desperate for new direction, investment, and opportunity. In Moldova 17% of the GDP is based on agricultural production and food processing. Agricultural product represents 50% of exports. But farming has long been in decline as large state farms and centralized agricultural systems have deteriorated or been abandoned. Labor has fled the country for employment opportunity in the West. 38% of Moldova’s GDP in 2010 was from stipends sent home from family members working abroad. Rural villages with a farming tradition are now disproportionately populated by the elderly and women. The production on subsistent farms cultivating one to three hectare plots is consumed largely by the farm family. Investment in small production units of high-value products for domestic markets, and larger commercial production of the same products for targeted export could have a positive impact in beginning to rebuild an agricultural economy for countries like Moldova. The opportunity presented by increased demand for hand-harvested fresh-market small fruits could make a large contribution towards this goal.

The opportunity is in fresh markets. As stated, many berry fruits destined for processing markets will increasingly be harvested by machines. The low cost for efficient machine harvested fruit is already setting the point-price paid by processors. Hand harvested berries for processing will only remain marginally competitive from developing countries for as long as living standards and wages remain depressed in those economies. To the contrary, berries for fresh markets, especially raspberries, blackberries, and strawberries, are necessarily harvested by hand everywhere in the world. If infrastructure constraints, investment barriers, and the complications of political borders obstructing trade can begin to be resolved, East Europe could become very competitive in fresh berry markets. Close-by Western markets are willing to pay strong prices for high quality fresh berries. Many domestic markets are under served. Horticultural traditions exist here. In many areas the soils and climate are conducive for production. Water is being made
available for irrigation. Labor costs can be expected to be lower than in the West for some time yet giving an initial competitive advantage to those who will seize the opportunity.

**Added to this encouraging outlook** has been the relatively recent introduction of North American highbush blueberries to Europe. Native to North America, this tasty, versatile, and healthy fruit is being discovered by new demographics world-wide. Fifteen years ago Japan did not know about blueberries. Today the Japanese import more than 10% of USA and Canadian production. Twenty years ago the first fruits of opposite hemisphere blueberry production began to dribble into North American and European winter markets from Chile. Today South America’s contribution to world production is 20%. Even as world production is soaring, demand grows stronger. USA per capita consumption of fresh blueberries has increased X5 in 10 years: from 0.12kg to 0.59kg per person.¹ Credible health news, an aging baby boom generation, and discovery by new populations makes blueberries a market driven phenomena that is here to stay. The fifteen year world market forecast cannot yet see a plateau. Europe, which possesses excellent climates and resources for growing the crop, and an expanding market, represents only 10% of world production. There is still plenty of room for new players. This certainly represents an opportunity that should be explored for Moldova.

**World New Blueberry Product Introductions**

II. **BACKGROUND ON THE ACED PROJECT**

¹ USDA- National Agricultural Statistics Service (NASS), reports 2012

² United States Highbush Blueberry Council, *New Products with Blueberries*-2012
The Transition to High Value Agriculture Project (THVA) of MCC's Moldova Compact Program plans to rehabilitate up to 11 centralized irrigation systems that will cover approximately 15,000 hectares of irrigated farmland in more than 30 localities around Moldova. Six of the irrigation systems (Jora de Jos, Lopatna, Cosnita, Criuleni, Puhaceni, and Roscani) are located on the Nistru River (the border with the Transnistrian region) and the other five systems (Chircani-Zirnesti, Blindesti, Grozesti, Leova de Sud, Cahul) are located on the Prut River, which forms the international border between Moldova and Romania. The actual rehabilitation work on these systems began in mid-2013 and the systems are expected to be completed between mid to late 2014 and late 2015. Annex A to this report includes a map of Moldova showing the location of the 11 selected CIS zones.

As part of this complex effort, the role of the ACED Project (which is jointly funded by USAID and MCC Moldova) is to assist farmers from CIS areas to transition from their current farming activities to the production of high-value agricultural crops (mainly fruits and vegetables) by providing technical support services, including training, technical assistance, market studies, export linkages, one-on-one consulting and other support as needed.

Since the launch of the project, ACED has focused on supporting the development of a limited number of high-value crops, including apples, stone fruit, table grapes, greenhouse tomatoes and cucumbers. The current range of ACED training materials, which has been developed to address issues dealing both with agronomy and postharvest handling of these targeted crops, are considered sufficient to meet the needs of CIS farmers when the time comes for the delivery of these modules.

Still, the development of other crops could be of interest for CIS growers. During a recent review of the Cahul and Zirnesti CIS areas\(^3\), the international experts noted that “Small fruit production, including strawberries, raspberries, blackberries, and blueberries have significant potential in the CIS zones. Proper drainage could be maintained by the establishment of raised beds for the growth of these berry crops. Early season fresh market production could be attained for the Moldovan market, in addition to fresh and frozen export market opportunities”.\(^3\)

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\(^3\) Travis Greenwalt, David Picha “Technical memorandum on due diligence on current and prospective economically-productive land uses for the historical irrigation command areas of Cahul and Chircani-Zhirnesti systems”, August 2013
III. THE ACED STRATEGIS APPROACH FOR YEAR THREE

Assessment of Berry Production Potential in MCC CIS Zones

Given the above background on the ACED project, and the potential for the development of berry crops within the CIS zones, the main objectives of this assignment were to:

1. Assess the current status of the production of berry crops among the farmers in the CIS zones and in the areas around the CIS areas;
2. Recommend interventions for ACED in these value chains, including training topics, new practices and technologies, new products, etc.
3. Provide guidance to ACED regarding the establishment of berry crop (in particular blueberries) demonstration activities within the CIS zones.

While the main focus of this assignment was on the potential for berry crop development within the CIS zones, ACED also used the consultant’s knowledge and experience in beekeeping to assist with an assessment of beekeeping as an area for project focus in Component 2 of the project, which provides assistance to farmers and agribusinesses in the Transnistrian region. To accomplish this, the consultant devoted two days to this effort as part of the assignment.4

Assessment of Current Berry crop Production

The current situation for Moldovan berry production is dire—at least from what was seen by this consultant on this assignment. Field production looked abysmal despite the apparent resources of a favorable climate, good soils, in some cases available water, in most cases irrigation distribution systems, for the larger producers often rudimentary but adequate technologies and implements, limited but available choices of fertilizers, soil amendments, and pest and disease control chemicals, and access to certified nursery stocks (imported). Plantings were lacking vigor, crop rows were most often choked with weeds, row middles or thoroughfares were not managed at all, bramble canes were weak and sparse, strawberry plants were stunted and diseased. Growers reported poor and declining yields. Perennial plantings are in demise ahead of their productive life expectancy. Strawberry plantings are reported by some farmers to fail after the first season. Despite potential, nothing was seen that might approach USDA-GAP standards.

Production problems are many:

1. There is a lack of capital and available credit to make improvement or invest in new enterprise.
2. Producers lack knowledge. They are uniformed concerning modern crop science.

4 A report presenting the findings from this activity may be found in Appendix C, “Honey Production Enterprise in the Transnistrian Region”
3. Competent extension services are not available to assist and fill the knowledge gaps.

4. Often water is not available in adequate supply. Where water is available, farmers don’t know the moisture requirements for their crops, how to monitor soil moisture, or how to manage and schedule irrigation.

5. Farmers are often sharing plant materials from their existing fields rather than planting certified disease free stock from a reputable nursery.

6. Farmers are often growing antiquated or inappropriate for-purpose varieties. The opportunity for hand-harvested fruits is in the fresh markets which have very exacting standards for quality.

7. Harvest conditions and standards are likely to be unsanitary.

8. Post-harvest cooling, packaging, and handling are substandard to non-existent. Again, even including a newly constructed cold storage facility of considerable capacity, nothing was seen that could even begin to approach a USDA-GHP audit without major infrastructure upgrades, owner/operator education, and employee training.\(^5\)

**Recommendations for ACED Interventions in These Value Chains**

**Stakeholder Training Programs**

A priority task for ACED in the remaining mission should be to develop for Moldova a “knowledge base” regarding small fruits, specifically berries that can be appropriate for domestic and export fresh markets. The list of production constraints above immediately suggests topics that need to be developed and presented as training programs for farmers, cold storage operators, distributors, and others in the fresh market berry value chain. People can’t hope for better until they know what “better” looks like. People can’t act on what they don’t know. These programs should include conference and seminars, international study tours, farm and demonstration plot visits, and individual consultations.

Topics would include:

1. Sources and appropriate use of credit.

2. Farm business planning with an emphasis on financial management and market driven high-value crops.

3. Western systems and crop science for commercial berry crop enterprise.

4. The role of irrigation and irrigation technologies currently available for successful berry crop enterprise.

5. Irrigation management for berry crops: rates of application, soil moisture monitoring, and irrigation scheduling.

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\(^5\) See Appendix E, *Consultant Activity Journal* for detailed listing of site visits, producer interviews, including consultant observations and notes. Also, Appendix D, *RHEI-VIT Strawberry and Raspberry Production Fields*, provides and in-depth investigation and recommendation for one representative example.
6. Identification of berry crop pests and diseases and IPM strategies for control of the same.

7. IWM strategies for effective control of weeds in perennial fruit crop plantings.

8. Pesticide application training

9. Introduction to new varieties and the importance of virus tested certified disease free nursery stocks.

10. Sanitation during harvest and handling of produce destined for fresh markets.

11. Harvest and post-harvest practices and technologies.

12. The necessity of establishing and maintaining the cold-chain from farm to consumer.

**New Practices and Technologies**

There are multiple recent innovations that could find useful application in efforts to establish improved fresh market berry production in Moldova:

1. **Drip irrigation** has been around now for a while, and is already widely used in Moldova on berry crops, but for many good reasons its use should be promoted for high-value crops. Among its attributes are
   a. Efficient use of the water resource. Because drip irrigation applies water directly to the crop row and the root system, and not to plant surfaces where it will evaporate or non-target areas where it cannot be utilized, 80% less water is used in meeting the needs of the crop.
   b. Fungi comprise the greatest number of diseases that need to be controlled. As plant surfaces are not wetted by drip irrigation, disease pressure is reduced.
   c. Relative to other systems, the components are inexpensive to purchase and maintain and simple to install and repair.
   d. As less water is required, less energy is used to pump it.

2. **Resistance block electronic soil moisture monitoring** is a big step up from vacuum tube tensiometers:
   a. The sensing device is buried out of sight and harm’s way permanently in the field. It cannot be damaged by freezing temperatures and is not as vulnerable to mechanical damage or theft.
   b. The “read-out” meter represents an investment of about $300.00, but individual sensors cost only about $25.00 each. Tensiometers cost about $70.00 each and are easily damaged or stolen.
   c. The electronic devise reads out in the same millibar scale as a tensiometer which avoids confusion.

3. **Non-invasive permanent sod culture** for brambles and blueberries provides multiple benefits. Thoroughfares are planted to a mixture of sod plants—predominately grasses—that have a bunching or crown growth habit as opposed to a creeping rhizomatous or stoloniferous habit. The appropriate sod plants should be seeded at the same time the crop is planted. Once the sod
establishes it will provide a permanent cover that does not readily invade the crop row as long as it is cut prior to setting seed. Benefits include:

a. Suppression of noxious weeds
b. An all-weather work surface
c. Clean harvest conditions
d. A beneficial cooling effect of the soil surface
e. Reduced soil compaction
f. Added fertility from grass clippings
g. Aeration of the soils from desiccating root tendrils
h. A beautiful work environment—like a park

4. **Pest monitoring using pheromone or attractant baited traps** makes crop protection programs more effective and less expensive. The farmer is notified of the presence of the pest and can determine from threshold-of-injury predictions whether or not an action is required.

5. **High-tunnel production** involves considerable investment and intensive management, but may be justifiable for the economic benefits of an early or an extended season. The plant surfaces and the fruit are also protected from rain and consequent disease pressure. Management of “greenhouse” pests, e.g. spider mites, can be a constraint.

6. **Convection air precooling of berries** combined with proper refrigerated storage, transport, and display extends the shelf-life of berries dramatically. Pre-cooling need not be expensive, “rocket-science”, or only for the larger producers. If a cold room or trailer is available near the field, it can be done for the minimal additional cost of a large window fan and large sheets of card board.

7. **Harvest and post-harvest equipment** has made enormous advances and is available in a full range of capacities that can serve the needs of small and large producers alike. Two hectares or more of high-value berry crops warrants consideration of these investments.

8. **Clamshell packaging** is now the world standard for fresh market berries. If the crop is destined for export or domestic markets other than local “green markets”, it will be a requirement. Labeling and “branding” might also be packaging demands the middle-sized and larger producers will have to consider.

9. **UPC bar codes** are another labeling issue larger producers may have to provide for inventory monitoring. The farmer should consult with his customer in advance of ordering his supplies to meet the requirements of the market being served.

10. **Audited certifications** for Good Agricultural Practices (GAP) and/or Good Handling Practices (GHP) are increasingly necessary to be able to sell into some market channels. Although not required by law yet in most places, more buyers are requesting these certifications every season, In Europe GlobalGAP, HACCP, EURO CERT, or ISO may be one of the certifications required to do business. Special markets may require additional certification such as Certified Organic or Fair Trade. Whether or not any of these certifications are **required**, a certification can be an
effective way to differentiate your product to attract customers or obtain a higher price, as well as provide some defense from liability complaints.

New Products

1. **In-vitro propagated plants** as genetic clones of the mother plant provide more consistent reliability that plants will perform true to name. In-vitro propagation also gives greater assurance of being disease free; the result is healthier, faster growing plantings, with fewer problems.

2. **Improved primocane bearing raspberry cultivars** now give us fresh market quality fruit in the extreme late season. Heritage, the first high quality primocane bearer remains one the standards where it can be ripened—it fruits very late. Exciting Polish and UK introductions such as Polana, Polka, Autumn Britten and Autumn Bliss fruit earlier. Polka does exceptionally well in the Balkans, and likely would do well in Moldova.

   The fruits are very large, bright color, firm, with good flavor and shelf-life. It is recommended that farmers only crop the fall berries on the primocanes. Summer fruit on these varieties from over wintering fruit buds on the floricanes are usually not up to standards. Following harvest during the dormant season, all canes are removed in preparation for new primocane growth in the spring. This practice also removes disease inoculum that might otherwise be carried over on overwintering canes, reducing disease pressure in the coming year.

3. **North American Highbush Blueberries** are a recent introduction to Europe. Poland got into the game early and has had great success in adapting the crop. Today Poland accounts for the lion’s share of the European crop, but as Europe only represents 10% of world production, there is room for many more players.

   Successful blueberry growing is all about “site”—either finding and working with good sites, or making marginal sites good sites with an understanding of the narrow parameters that blueberry plants require.
   a. For starters, acidic soils are a must—pH 4.5 up to 5.2 would be perfect. Soils can be acidified, but it may take eight months to a year for a complete response to amendments such as elemental sulfur. Soils >pH 7.5 may be unsustainable for blueberry culture. Reports indicate that many areas of arable land in Moldova test >pH 7.0; however two sites that were visited reported tests in the pH 5.8 to 6.0 range.
   b. Secondly the soils need to be well drained—both at the surface and internally. Light porous soils, high in organic matter, with depth to the water table of not less than 1m would be perfect. Again we can remediate a marginal site using raised beds and mixing the native silt or clay soil in the row 1:1 with sawdust or peat. Digging pits in tight poorly drained soils to be replaced with a lighter growing medium only creates “swimming pools” that will quickly drown the roots.
   c. Thirdly, as much as blueberries demand good drainage, soils must remain moist ALL THE TIME. When soils dry out, even in a short “drought” period, blueberry roots
die back—stunting growth—sometimes severely damaging or even killing the bush. In nature, blueberries don’t grow in the bog, but they like to grow near the bog. They don’t want to stand in water, but they like to have their “toes tickled by water” all the time. On most sites supplemental irrigation is a necessity. For this reason, the CIS zones where the availability for irrigation water is being restored should be top candidates to be investigated for blueberry production viability.

d. Finally, winter is a requirement. Blueberries are a temperate zone plant—and depending on species and variety require an accumulation of “chill” hours below 6°C of from 400-2500 hours. Northern Highbush, *Vaccinium corymbosum*, will provide the selection of cultivars appropriate for Moldova, and are usually satisfied with 800-1800 hours.

e. Less critical site requirements are at least ½ day of full sun (don’t multi-crop the apple orchard!), cool soil temperatures which can be provided by mulch and permanent sod culture, air drainage, and windbreak shelter from prevailing winter winds.

4. **New generation crop protection materials** are a far cry from the DDT of Rachael Carson’s *Silent Spring*. The crop protection industry is responding to concerns of consumers and farmers and giving us products that are “green”, safe, non-residual, and yet effective. Many are derived from natural materials; some are now ORMI registered for certified organic management programs. Products like Serenade for fungal diseases and Spinosad for fruit worms are but two examples of this new generation of pesticides. The list of allowable materials for use in Moldova is short, but we should work for change, and currently we are not without tools. Always faithfully abide by the label.

5. **Foliar applied fertilizers** have a place in modern horticultural crop management. They can provide a short term fix for a crisis issue regarding deficiencies, e.g. the use of chelated iron (Fe) in a situation where it will take time to correct a pH issue in the soil. They can also be an excellent solution for peak demand growth stages for other specific micronutrients and are often compatible with crop protection materials so they can “piggy back” on other cover sprays. However, they should not be depended on for basic seasonal crop nutrition—after all, roots, not leaves, were designed for the uptake of essential moisture, minerals, and the basic elements required for healthy plant function.
IV. KEY CONSULTANT ACTIVITIES

During the assignment in Moldova, the consultant was assisted by, and received support from, an ACED-hired local national consultant. A series of field visits and farmer meetings in the CIS zones were made. The consultant assisted by the local consultant and ACED technical staff also conducted the following activities:

1. **Available data on the 11 CIS zones covered by the MCC project was reviewed** to determine if there could be appropriate sites within the zones that would support berry production. There is sufficient evidence in these reports that should encourage ACED pursuing a strategy in support of production of high-value small fruit crops. Appropriate sites would need to be identified. Soils should be porous and well drained internally as well as at the surface. High organic matter will be preferred. The soil pH should be within proper range, or able to be brought within range, according to the requirements of the crop. Blueberries, which require very acidic soils, should be of particular concern for proper siting. Sufficient water to meet seasonal irrigation requirements will need to be available.

2. **Producer visits in or near CIS zones:** The current farming activities being undertaken by berry growers around selected CIS areas were investigated. Three berry production sites in/near Jora de Jos CIS region near the Nistru River were visited.
   a. **Arbustina Field Production:** Mr. Oleg Zaharia began production in 2005. He is presently producing 15ha of red raspberries, down from the 25ha he had planted in 2005. He plans to replace the lost 10ha of plantation. His crops are marketed as “organic” but are not certified. Although the farms are not in a CIS zone, the company has improved its own capacity for irrigation and will expand the system. Polana red raspberries are cropped on both primocane and floricanes. He also grows a Russian variety, Creposh.
      - The plantings appeared depleted, stunted, lacking density and vigor, and were choked with grass and weeds.
      - Fruit is packed in the field in 600g clamshells x4/case, moved to 1°C cold room in 1-2 hours, and shipped to markets within 12 hours.
      - The 2013 price paid was 2.00€/kilo.
   b. **Mr. Ion Voica, President of Water Users Association for Jora de Jos command area,** is planning for a 1 ha strawberry and raspberry development.
      - The development site is immediately adjacent to a CIS pumping/ponding station that will be rehabilitated in the coming year.
      - The field looked beautiful having just been plowed. Recent rotations of corn/alfalfa/cereal grains have been produced on this site. Soils appeared to be a dark sandy Loam. A Soil pH test was not available, but the pH is believed to be about 7.0.
• If well drained, this could be an excellent site for small fruits when water becomes available for irrigation.

c. Farmer #3 visited is growing day-neutral strawberries on small plots near his home in a village within the Jora de Jos command area.
  • The plots were NOT being irrigated.
  • A double ribbon-row system without mulch was being used.
  • The farmer expressed a desire to do tunnel production.

Three sites in/near Cosnita, Criuleni CIS regions near the Nistru River were visited. Two CIS systems are being rehabilitated: One serves 2 communities with 700ha which may be linked to a 3rd community with an additional 300ha. A second system is serving 3 communities with 800ha. Mr. Gavzilou Tzojim, Executive Director of Agricultural Producers Association was our guide. He reported that there are many potential investors expressing an interest in establishing strawberry/raspberry production in the zones. Immediate lack of irrigation water damaged 17ha of blackberries during the recent drought. A Strawberry disease problem (most likely Fusarium) has been a significant constraint. Lack of a registered control was blamed for lost production.

d. Farmer #4 was “new” to strawberry culture.
  • He has established a small “hothouse” production of day neutral strawberries (a smaller portion of which was 100 Albion plants).
  • Most are a Russian variety of shared plants from neighbors
  • The management system was Irrigated double ribbon rows.
  • There are unacknowledged sanitation issues at this site with nearby toilet, poultry runs, and access by domestic animals (cats and dogs).
  • This will be a short term enterprise as implemented as there is no apparent capacity for rotation. Fusarium and other soil borne diseases building up in the soil will likely become a limiting factor.

d. #5 visited is a small area farmer within the village and CIS zone.
  • He is producing small plots of raspberries, blackberries, and strawberries
  • There is no room for expansion on this site, but improvements could be implemented regarding his present plantings of perennial fruits.
  • He requested and was provided with a raspberry pruning presentation and demonstration.

e. #6 visited is a young farmer nearer to Chisinau whose family farm is not within a CIS zone
  • The farm is a 3.6ha off-site family operation: The head of household presently works in Germany as necessary (this is expressed as a temporary arrangement), an older brother also works in Chisinau, and the younger brother (the individual interviewed) is a horticulture student in Chisinau with a desire to farm fulltime.
  • Grapes, raspberries, blackberries, and strawberries are presently produced.
  • The berry plantings were 2 and 3 years old. The grapes were more established.
• Plantings looked sparse, stressed, weed choked, lacking vigor. Irrigation is hauled up to this hilltop site in barrels to fill a large water tank reservoir for a gravity flow drip system on the berries.
• The older brother is a welder and constructs unique small tillage equipment.
• The young man expressed confidence and commitment for the enterprise.
• The farm is marketing fresh fruits daily in season to Chisinau markets.

3. **Arbustina Cold Storage**, Mr. Oleg Zaharia, is a vertically integrated distributor/packer/producer. His cold storage was developed 2011. The facility includes modern high-tech refrigeration units. The new building is still in need of some competition. Arbustina is aggregating perishable shipments on pallets on an open-air dock where produce awaits final loading.
   a. 1600T capacity with 4x200T and 8x100T cold rooms.
   b. Refrigeration and freezing capabilities.
   c. Will add a sort/pack line for tree fruits as an expansion.
   d. He has excess capacity: he handles his own production, buys some local production, and imports non-domestic products (e.g. bananas, pineapple).
   e. Arbustina distribution is primarily local (domestic), but also to markets in Ukraine, Belarus, Russia, and small amounts to Romania.
   f. Poor sanitation—would not sustain USDA GAP/GHP audit without substantial upgrades in infrastructure, company protocols, and employee training.

4. **Rhei-Vit, fruits and vegetables processor and farms**, represented by Mr Rodion Gudim, Director for Raw Material Supply and Agriculture, is a vertically integrated business of considerable capacity. Established 1945 as a State owned industry, it is now privately owned by Moldovan/American interest since 2001. A site visit and consultation regarding the company’s strawberry and raspberry plantings was requested.
   a. 2.7 Ha Strawberries. All Elsanta var. purchased as frigo from an Italian nursery. Planted in three blocks in successive years from 2011. Plan is to crop three years and remove. Double ribbon rows on plastic. Irrigated.
      • Declining yields and vigour
      • Clay soils with drainage problems and a high pH at 8.0 were reported. The company has attempted to mitigate problems by mixing lighter soils from a distant site with apple pressings and peat imported from Belarus. This intervention only moved pH to 7 in some scattered areas.
      • A 12T strawberry yield is down from 18T a year ago.
      • Leaf samples showed Fe deficiency.
      • Recommended treatment with chelated Iron foliar spray.
      • Strawberry crowns are subject to injury at temperatures < -12C. Company should consider a winter straw cover on the field.
      • No irrigation is used other than pass-by applications from tanker trucks.
• The field has sodered-in. There is no management of weeds in rows or thoroughfares.
• 500 k/ha raspberry yield and declining.
• Recommended irrigation, weed controls, thoroughfare management, and increased fertilizer applications for the coming season.
• Provided a comprehensive report.

5. **Met with Dr. Sava Periscovia**, president of “Bacifera”, and strawberry research and extension professor at the Moldovan Horticultural Institute. Assessed “Bacifera”, the Moldovan National Berry Producers’ Association and local national consultants with capabilities to assist berry farmers.
   a. Periscovia joined the consultant for a day of CIS site visits.
   b. She also shared the podium at the ACED Berry Training Seminar in Chisinau for Moldovan producers.

6. **Assisted SRI Lolly Berry Company**, in the development and imminent implementation of a business plan for a 10ha blueberry plantation scheduled for planting in 2014. Three meetings were held with Mr. Tarai Iurii, owner/operator, to discuss his plans, including a tour with him at the project site.
   a. An overview of the general plan was shared at an introductory meeting in Chisinau. A parcel of land has been purchased and the 10ha portion of the property on which blueberry production is intended is presently being prepared.
      • Wants consultant help with planning
      • No prior agriculture experience but considerable business acumen.
      • Has capacity for investment/development and has done considerable “homework”.
      • Planning to be ready to establish bushes in fall 2014.
      • Wants to expand in the future.
      • Considering Duke, Bluecrop, and Brigitta as varieties to plant.
      • His plan will include on-site packing and cold storage infrastructure.
   b. The second meeting was a tour and evaluation of the Lolly Berry blueberry development site west of Chisinau.
      • 15 years pasture.
      • A portion of the land was cropped in corn for 2013.
      • Corn residue was plowed down and pasture was recently disked.
      • Water sources are reportedly available but undeveloped.
      • Power can be made available, but is not yet at the site.
      • The land fronts a surfaced highway, otherwise is surrounded by forest.
      • 2-10% slopes. No signs of erosion
      • Soils: Loam. Light color. Percentage OM unknown. Well drained at the surface and internally (recent rain presented no standing water and good tilth where drying). Wetter soils below 10cm slightly slippery.
      • No history of recent herbicide use or environmental contamination.
- pH 5.8-6.0 at 10 cm with resistance meter consistent with lab soil test. Depth and collection protocol of sample profile for lab test unknown.
- Stakeholder is applying 1T/ha granular sulfur (Polish product). Application was being made while we were present on-site.

C. At a third meeting with Iurii regarding the SRI Lolly Berry farm business development, recommendations were made regarding the information that had been collected.
- Discussed land preparation
- Interpreted soil tests
- Evaluated variety selections
- Planned layout and plant spacing
- Evaluated Polish nursery offer
- Provided “Best Practices” check list guide for blueberry establishment
- Prepared enterprise budget

7. Developed and/or edited five Power Point Presentations which served 76 stakeholders participants attending two day-long berry production training seminars and one honey production roundtable. The presentations included:
   a. Small Farm Honey Production in Wisconsin, USA
   b. Blueberry Production Potential for Moldova
   c. Blueberry Cultivars for Moldova
   d. Blueberry Establishment
   e. Raspberry Production for Fresh Markets
V. CONCLUSIONS

Throughout the temperate climate regions of the world where substantial production of apples, cherries, pears or plumbs is found it is common to find the successful production of commercial berry crops—strawberries, currants, raspberries, blueberries, and blackberries. Generally favorable conditions for one of these crops suggests the possibility for the others: rich soils high in humus, porous soils that are both well drained and aerated, slightly to considerably acidic soils, a winter period with sufficient chill yet not cold to the extreme, ample moisture, warm summers with sufficient heat units for fruit ripening. Apples are a significant crop in Moldova. Strawberries, ribes, and brambles have been proven here.

Although Moldova can be subject to dry periods, even occasional droughts during the summer months, there is water here—major rivers and their tributaries. During the Soviet period substantial systems distributed this water as irrigation over thousands of hectares of arable land. Lands that once supported horticultural crops will be able to support horticultural crops once again, as these systems are restored. The findings of the recent assignment support these observations. New investments in high-value, market-driven crops, like berries, can play a part in building a new Moldovan agricultural economy.

The timing for such an initiative couldn't be better. Hand-harvested fresh berry crops are in high demand both in the east and the west. High prices are paid for quality fresh products. Added to the selection of berry fruits long popular in Europe is a new comer from North America, the highbush blueberry, *Vaccinium corymbosum*. Bolstered by media-reported news of the health benefits of this delicious berry, it is taking markets worldwide by storm. There is room in Europe for additional production as the market continues to expand. Moldova will be one of those regions capable of blueberry culture.

Berries: high-value, labor-intensive, economically sustainable on small areas—the perfect family-farm enterprise—and an exciting development opportunity.
Agricultural Competitiveness and Enterprise Development Project

Annex A
Map of Moldova Showing the Location of the 11 Selected CIS Zones

The aim of the 2010 – 2015 Millennium Challenge Compact in Moldova is to help increase the incomes of Moldovan population by developing road infrastructure, rehabilitating irrigation systems and encouraging the transition to high value agriculture.

The Transition to High Value Agriculture Project of the Compact seeks to act as a catalyst for the investments in high value production by establishing a successful and sustainable model for irrigation systems and water resources management and creating a conducive institutional and policy environment for irrigated agriculture and to increase rural incomes by stimulating growth in high value agriculture.

The major activities meant to facilitate the transition to high value agriculture are:
- Rehabilitation of up to 11 irrigation systems;
- Irrigation Sector Reform, including the legal transfer of the management of the rehabilitated systems from the Government to 11 Water Users Associations, established with Compact assistance;
- Facilitation of access to agricultural finance through the Post-Harvest Infrastructure Credit Facility;
- Growing high value agricultural sales.

Centralized irrigation Systems to be rehabilitated.
Beneficiary communities within irrigation systems areas

EXPECTED RESULTS
- 11 Water Users Associations established for about 6000 agricultural producers
- Access to water for irrigation for over 15 500 hectares of farmland
- Training in advanced agriculture technologies for about 5 thousand farmers
Annex B
Lolly Berry Blueberry Farm Development Report

AGRICULTURAL COMPETITIVENESS AND ENTERPRISE DEVELOPMENT PROJECT

November 19, 2013

SITE VISIT & BUSINESS PLAN EVALUATION: Lolly Berry Blueberry Farm
Mr. Tarai Iurii, Director
MD-6425, Republica Moldova, r.l. Straseni, s. Dolna, str. Puskin, 25

REPORT AND RECOMMENDATIONS:
Lolly Berry, a Moldovan privately held business proposes to establish a 10 hectare plantation of North American Highbush blueberries, *Vaccinium corymbosum*. Land has been purchased just off the main road to Romania less than one hour from Chisinau fronting a paved highway. Work has begun to improve the site. A fall 2014 planting date is planned.

Soils: Tests reveal that the soil acidity at the site is pH 6.0. A soil pH of 4.5 to 5.2 is the normal range recommended for healthy blueberry culture. Elemental sulfur was being applied at a rate of 1 T per hectare on the day the site was inspected, November 8, 2013. Eight to ten months are required for the sulfur to complete the acidification process, so the timing of this application is excellent. The rate applied should lower the acidity to within proper range at approximately pH 5.0. Blueberries are commonly produced on soils testing as high as pH 5.5. Additional sulfur can be added at a later date if indicated by subsequent soil testing or plant response.
### Elemental sulfur needed to lower pH to 4.5 (kg/hectare)

<table>
<thead>
<tr>
<th>Current pH</th>
<th>Sand</th>
<th>Loam</th>
<th>Clay</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.0</td>
<td>195</td>
<td>589</td>
<td>889</td>
</tr>
<tr>
<td>5.5</td>
<td>389</td>
<td>1145</td>
<td>1778</td>
</tr>
<tr>
<td>6.0</td>
<td>589</td>
<td>1712</td>
<td>2556</td>
</tr>
<tr>
<td>6.5</td>
<td>734</td>
<td>2245</td>
<td>3368</td>
</tr>
<tr>
<td>7.0</td>
<td>934</td>
<td>2845</td>
<td>4257</td>
</tr>
</tbody>
</table>

### Potash and phosphate recommendations

<table>
<thead>
<tr>
<th>Soil test (ppm)*</th>
<th>Soil test Recommended rate (kg/hectare)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>K2O</td>
</tr>
<tr>
<td>All soils</td>
<td>Mineral soils</td>
</tr>
<tr>
<td>0-10</td>
<td>100</td>
</tr>
<tr>
<td>10-20</td>
<td>83</td>
</tr>
<tr>
<td>20-30</td>
<td>67</td>
</tr>
<tr>
<td>30-40</td>
<td>33</td>
</tr>
<tr>
<td>40-50</td>
<td>22</td>
</tr>
<tr>
<td>&gt;50</td>
<td>0</td>
</tr>
</tbody>
</table>
The soil test also reveals that available phosphorous and potassium are well within limits. At 116 ppm K\(_2\)O, and 56 ppm P\(_2\)O\(_5\), no additional potassium (K) or phosphorous (P) should be added during the year of planting. Nitrogen (N) is very soluble and subject to change according to conditions and demands. We don’t normally test the soil for (N). The percentage of organic matter (OM), or humus, is a better indicator of potential nitrogen availability. No additional fertilizer is recommended at this time.

The organic matter (humus) is lean. We would like to see an organic matter of 3% or more. Humus is the source of many nutrients-especially nitrogen (N). Organic matter also affects tilth, drainage, and the soil’s capacity to hold moisture. Peat or sawdust can be added to the planting bed 1:1 with native soils. Either mix the amendments with the soils from the planting hole when it is dug, or a better method is to top dress the entire row to a width of 1 meter and rotary till the saw dust and/or peat into the row before planting. Following planting, the entire row can be mulched with organic mulch (wood chips and/or sawdust recommended) to a depth of 5-10cm. This mulch should be renewed every third year.

Blueberries are light feeders and generally find most of what they need in balanced soils with sufficient moisture. They tend to respond most to nitrogen applications, however immediate yields may not be affected and overly vigorous growth may not set hardy fruit buds resulting in plants that may be more susceptible to cold injury. No additional Nitrogen should be applied at planting and care should be taken in subsequent years not to exceed recommended rates.

<table>
<thead>
<tr>
<th>Years plants have been in the field</th>
<th>Actual N</th>
<th>Urea (46% N)</th>
<th>Ammonium sulfate (21% N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>70</td>
<td>150</td>
<td>333</td>
</tr>
<tr>
<td>6</td>
<td>50</td>
<td>110</td>
<td>239</td>
</tr>
<tr>
<td>4</td>
<td>35</td>
<td>78</td>
<td>167</td>
</tr>
<tr>
<td>2</td>
<td>17</td>
<td>39</td>
<td>83</td>
</tr>
</tbody>
</table>

**Nitrogen recommendations (kg/ha)**

**VARIETAL SELECTIONS:** A mix of Duke, Bluecrop and Brigitta is planned in three equally sized blocks. These are all Northern Highbush types which require seasonal chill of 800 to 1500 hours. If these varieties prove suitable for the climate here, all three would contribute to make a good planting. The selection provides a diversity of early, middle, and late fruiting plants. All can be expected to yield high quality fruit if managed properly.

**Duke** is an excellent choice for early season. Following its release, this cultivar quickly became the plant of choice for northern growers wanting an early fruiting variety. It is a hardy upright bush,
producing fancy fruit that is large, consistent size, mild flavored, firm, easy to pick. Duke provides heavy yields, excellent post-harvest quality, and a short ripening sequence.

**Bluecrop** has been the favorite main-season crop for many northern growers for the past 20 years. Its only constraint can be uneven ripening, face to back, resulting in "red back" berries if picked too early or too frequently. The recent introduction **Draper** might prove to be a better choice if it is available as it exhibits all of the qualities of Bluecrop and ripens consistently; otherwise Bluecrop will serve as an excellent choice if properly managed.

**Brigitta** is popular in Poland as a late crop. Experience with Brigitta in the USA is limited. It is known to fruit late in the season and would round out the harvest calendar. Fruit is very high quality for fresh markets. There have been reports that yields can be inconsistent year to year. A new late variety which could also be considered is **Liberty**. It has been given good reviews from growers and researchers.

The technical description of the nursery stock being offered by the Polish nursery that has been solicited is appropriate: two year old plants, container grown, 1.5 liter pots, and 40 cm tall. The price and terms of the offer are also reasonable and within standards. A copy of the offer is attached as an appendix to this report.

**Field layout plan**: The site presents slopes of 5-15%. It is recommended to align the rows along the contours of the hills to slow run-off and hold water on the field. Rows planted in the valley would be arranged at 90° to the rows planted across the hillsides.
Blue crop is known to be fairly hardy against cold, especially during bloom. Duke is also hardy, and avoids frost in bloom as it blooms later than most other varieties. The response of Brigitta to cold, relative to the other two varieties, is an unknown. Therefore it is recommended to plant Brigitta on the higher ground.

The standard recommendation for plant spacing for Northern Highbush blueberries is 3m x 1.2m. This creates a plant density of approximately 2778 plants. If not already owned or available, at some time in the future (5-7 years out) a narrow base (1-1.25 m) “vineyard” tractor will be required for field operations. As the bushes are small during the establishment period, a standard utility tractor will have adequate room for all field operations.

**IPM Disease and Pest Management:** Attached to this report is a list of common diseases and pests affecting blueberries, several of which are known to be present in Europe at this time. The listing includes recommendations for IPM control of these potential problems. A copy of the illustrated Michigan State University publication, “A Pocket Guide to IPM Scouting in Highbush Blueberries” will also be provided to assist in pest/disease identification and management.

Also attached is publication prepared by this consultant, “Best practices” for growing and establishing blueberries. This document is intended to serve as a project guide identifying necessary considerations and cultural practices to be implemented if the enterprise is to be successful.

**Infrastructure Improvements**

Water management is the most critical aspect of blueberry production. Blueberry plant roots subjected to even short periods of drought will be severely damaged. At the same time, Porous soils with good internal drainage are required. Blueberry plants will not survive in saturated soil
conditions. To achieve the continually “moist” but not overly “wet” conditions required for healthy blueberry plant performance on necessarily well-drained soils, irrigation is usually required to supplement periodic rainfall.

A necessary improvement at the site before plants can be planted in fall of 2014, will be a functional irrigation system. For a ten hectare development, this system will require a capacity to deliver approximately of 850,000 liters of water on a weekly basis (85,000 liters per ha) as needed. This estimate assumes that a trickle irrigation application system will be used. If an overhead sprinkler system is to be used, the water requirement would need to be multiplied by five, or approximately 4,250,000 liters available on a weekly basis as needed.

Harvest and Post-Harvest Technologies are desired for the enterprise. An on-site cooling, sorting/packing and cold storage facility is being considered. As it is recommended that the blossom and green fruit be removed from the plants during the first two seasons of establishment, 2015 and 2016, there will be no crop to be harvested and processed until the 2017 growing season. A plan to implement these improvements can be developed and implemented over the next 2½ years. It is recommended that the farmer focus on establishing production during the initial implementation period.

An Enterprise Budget for Fresh Market Blueberries is attached. It should be understood that this model budget is intended as a planning tool only. It does not constitute a business plan nor can outcomes of actual experience be guaranteed to correlate exactly with the totals illustrated in the budget. It is however closely correlated with the 35 year business experience of Highland Valley Farm at Bayfield, Wisconsin. Every effort has been made to transpose the values of the budget to conditions that could be expected in Moldova. Volumes, weights, and measures are metric. Values are expressed in USA Dollars.
Annex B1

Nursery Stock Offered by Polish Nursery

Gospodarstwo szkolarskie
Krzysztof Botul
Zlota 135
96-130 Gluchow
Poland
Tel: +48 602-42-74-44
Email: poczt@borowka.pl

Tender

SRL "Lolly-Berry" („you”)
MD-6425, Republica Moldova,
cod fiscal - IDNO : 1013600032495

28 October 2014

Dear Sir

I, Krzysztof Botul, the owner of blueberry farm, a registered nursery of high blueberries and other crops nursery, have a pleasure in offering you, SRL „Lolly-Berry”, 30 000 (thirty thousand) seedlings of blueberry high (Vaccinium corymbosum L.). The offer is made on the following terms and conditions.

1. We can provide you with the following types of high blueberry:-
   1.1 Duke - 10 000 (ten thousand seedlings)
   1.2 Bluecrop – 10 000 (ten thousand seedlings)
   1.3 Brigitta – 10 000 (ten thousand seedlings)

2. The seedlings we offer are:
   2.1 Two years old
   2.2 In 1.5 litre, fully rooted pots
   2.3 At least 40 centimeters tall

3. Delivery terms:
   3.1 EXW Zlota
   3.2 You will organise the transport and collect the seedlings during the period from 1 September 2014 to 30 October 2014
   3.3 We will load the crops and provide you with the following documents:
      3.3.1 Phytosanitary certificate
      3.3.2 VAT invoice

Gospodarstwo szkolarskie Krzysztof Botul is a registered nursery of the blueberry and other crops. All the seedlings in our nursery are under the control of the State Inspectorate of Plant Protection and Seed. All seedlings are grown in Poland. The registration number is PL 18/15/13672 and the VAT number is PL 837-162-59-98
3.3.3 CMR note
3.3.4 Waybill
3.3.5 A letter confirming the country of the seedlings’ origin

4 Price and other terms:
4.1 The price of each seedling is 1.5 EUR (one euro and fifty cents)
4.2 Total price for the offer is 45,000 EUR (forty five thousand euro). The VAT rate is 0%
4.3 The offer is open until 30 October 2014
4.4 The offer shall be treated as agreed once the contract is signed by both parties and deposit, equal to 5% of the total value of the offer, is paid by you to our bank account.

5 Warranty
5.1 The warranty on the plants - 1 year

We would also be very happy to provide you with our advice in respect of establishing and running the blueberry farm. The advice is free of charge. If you have any questions please let me know.

I look forward to hearing from you soon.

Yours faithfully,

Mr Krzysztof Botul
Appendix 1 - Technical specification

SRL "Lolly-Berry" ("you")
MD-6425, Republica Moldova,
cod fiscal - IDNO: 1013600032495

28 October 2014

Variety description

1. Duke
   - Bush: vigorous, upright
   - USDA zone*: 4-7
   - Season: early
   - Fruit size: large
   - Crops: high yield, 5-6kg/bush
   - Qualities: Valued for its earliness and yields

2. Bluecrop
   - Bush: vigorous, upright
   - USDA zone*: 4-7
   - Season: middle
   - Fruit size: large
   - Crops: high yield, 5kg/bush
   - Qualities: the best variety World around, standard for other varieties.
3. Brigitta
   - Bush: upright, slightly spreading
   - USDA zone*: 5-8
   - Season: late
   - Fruit size: large
   - Crops: up to 5kg/bush
   - Qualities: Extremely good post-harvest storage, logn shelf life

*Moldavia is in zone 6 according to USDA (United States Department of Agriculture)

Mr Krzysztof Botul

Gospodarstwo szkółkarskie
Krzysztof Botul
Złota 135
96-130 Głuchów
Poland
Tel: +48 602-42-71-44
Email: poczta@borowka.pl

*Gospodarstwo szkółkarskie Krzysztof Botul is a registered nursery of the blueberry and other crops. All the seedlings in our nursery are under the control of the State Inspectorate of Plant Protection and Seeds. All seedlings are grown in Poland. The registration number is PL 10/15/13672 and the VAT number is PL 835-110-59-98.
# Annex B2

## Blueberry Pests and Disease and IPM Controls

<table>
<thead>
<tr>
<th>Pest, disease</th>
<th>Description</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stem Canker</strong></td>
<td>There are several Stem Canker diseases of Blueberries. Most are fungi and present similar symptoms and respond to similar controls. The most significant symptom is the sudden collapse of mature individual stems of an otherwise healthy looking plant. This event is usually referred to as “flagging” as the reddening leaves of the dying or dead cane are sure to attract attention. The point of infection is usually near the base of the affected cane where a red or brown “bull’s-eye” pattern may first appear around the infection site. Over time this develops into a canker which will completely girdle the cane within two to three years, at which time the vascular system of the stem is completely compromised causing the collapse.</td>
<td>Prune out infected canes below the point of infection in dry weather. Remove prunings from the field and destroy. Any cultural practice which increases sunlight penetration and air-flow within the bush to promote rapid drying after rain, fog, or heavy dew will help to prevent infection and spread of the disease. Such practices would include planting on slopes, proper plant spacing, and timely pruning on an annual basis. A dormant spray of Lime-sulfur or an approved copper spray can be helpful.</td>
</tr>
<tr>
<td><strong>Fusicoccum putrefaciens</strong></td>
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<tr>
<td><strong>Phomopsis vaccinii</strong></td>
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<td></td>
</tr>
<tr>
<td><strong>Mummy Berry</strong></td>
<td>Fungus. The most common fungal disease of blueberries affects both shoots and fruits. Infection occurs first in early spring as spore from small brown mushroom fruits on the ground below bushes contact emerging shoots during wet periods. During this “shoot strike” phase, new green shoots turn black and droop. Secondary fruiting bodies form on the dying shoots and release a sporulation as flowers open which can then infect the fruit that will develop. The berry is completely colonized and will present a salmon color and a somewhat fluted shape like small “pumpkins”. Infected berries become mixed with the harvest or drop to the ground where the disease winters in the dried berry casings to emerge again in the spring as small brown mushrooms renewing the cycle.</td>
<td>Cultivate or rake the ground under the bushes early to disturb and destroy emerging mushrooms or bury the mushrooms at this time with renewed applications of mulch to reduce or prevent infection during the shoot-strike phase. Some approved herbicides applied early for weed control may also provide some protection. Airblast coverage with an approved fungicide if shoot-strikes are observed may prevent the secondary infection of fruit.</td>
</tr>
<tr>
<td><strong>Monilinia vaccinii</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Leaf Spot</strong></td>
<td>Fungus. Are widespread, but tend to be more prevalent in warmer climates. Characterized by small brown leaf spots.</td>
<td>Plant resistant varieties. Limit overhead irrigation. Reduce humidity in the canopy. Apply effective</td>
</tr>
<tr>
<td><strong>diseases</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disease</td>
<td>Description</td>
<td>Prevention/Control</td>
</tr>
<tr>
<td>---------</td>
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</tr>
<tr>
<td><strong>Septoria</strong></td>
<td>with purplish margins. Larger reddish brown lesions may also form. Severe infection can cause premature defoliation of the bush. Infections occur on immature leaves and may take a month to develop fully. Causal fungi produce water-splashed –dispersed spores and overwinter in infected material.</td>
<td>fungicides before the onset of symptoms</td>
</tr>
<tr>
<td><strong>Gloeosporium</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Alternaria leaf spot and fruit rot</strong></td>
<td>Alternaria tenuissima Fungus. More widespread as fruit rot. As leaf spot the disease exhibits circular spots 1-5mm tan or grey in color surrounded by reddish border. Usually presented only on lower leaves, but severe infections can defoliate the plant. On ripe fruit, sunken areas near the calyx are covered by a dark green velvety growth. Stored fruit: entire berry may become covered with grayish-green green mold. Infected fruit becomes soft and shriveled. Leaf infections occur in spring during periods of wet cool weather. Fruit infections occur as fruit begins to ripen. Disease development is optimal at 20C.</td>
<td>Plant resistant varieties. Reduce humidity in planting. Apply fungicides bloom to harvest. Harvest in timely manner. Handle berries dry. Cool fruit rapidly after harvest and store at 1C</td>
</tr>
<tr>
<td><strong>Anthracnose</strong></td>
<td>Colletotrichum acutatum Fungus. Serious fruit rot problem. Stem and leaf lesions are more sporadic. On ripe fruit presents sunken areas with gelatinous orange spore masses. On leaves, lesions are reddish brown with distinct borders. On young canes, lesions are dark brown in concentric circles. Lesions may originate in infected buds and kill a part of the twig. Disease overwinters in infected twigs and buds. Spores produced on infected tissue tend to be released in spring between bloom and early fruit development. Dispersed by rain splash. Prolonged wetness (more than 12 hours) and temperatures between 20-25C promote disease development. Infections of fruit remain latent until ripening or post-harvest.</td>
<td>Prune out old infected wood. Keep canopy open to sun and air. Reduce humidity. Plant resistant varieties. Limit overhead irrigation. Apply effective fungicides from pinkbud stage to harvest in a timely manner. Pre-cool immediately following harvest and store at 1C</td>
</tr>
<tr>
<td><strong>Shoestring Virus</strong></td>
<td>Shoestring virus Widespread disease. Symptoms appear about four years after infection. Reddish streaks 3 to 20mm long appear on green stems—especially on sun side. Infected leaves are red or purplish, elongated and strap-like. May become cupped if one side of leaf fails to develop. Flowers maybe reddish and fruit may appear red or purple rather than blue. Bushes decline slowly. Disease is vectored by blueberry aphid (Illinoia</td>
<td>Remove infected bushes. Plant only virus tested plants. Plant resistant or tolerant varieties. Apply effective insecticides when aphids first appear.</td>
</tr>
<tr>
<td>Pest</td>
<td>Description</td>
<td>Control</td>
</tr>
<tr>
<td>------</td>
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</tr>
<tr>
<td><strong>pepperi</strong>.</td>
<td>Infection begins with aphid emergence in spring and continues to leaf drop in the fall. Aphids move from infected bushes to healthy bushes as they feed.</td>
<td>Monitor by collecting buds in plastic bags. Hold at room temperature until larvae emerge. Control early in the season with effective insecticide sprays.</td>
</tr>
<tr>
<td><strong>Gall Midge</strong></td>
<td><em>A Cecidomylid</em> fly. Very small. Adults are only 3mm. Difficult to see. Females lay up to 20 eggs in swelling buds. White larvae develop inside damaging leaf and flower buds. At maturity, larvae are yellow or orange color and only 1mm in length. Multiple generations occur each season. Infected buds dry up and disintegrate. Later egg laying occurs on vegetative shoot tips. Tissue damage is blackened and may be mistaken as fungal disease damage.</td>
<td>Monitor by collecting buds in plastic bags. Hold at room temperature until larvae emerge. Control early in the season with effective insecticide sprays.</td>
</tr>
<tr>
<td><strong>Cranberry Fruit Worm</strong></td>
<td>A single generation pest, CBFW is a serious fruit worm problem in many blueberry production areas. Uncontrolled, it can cause considerable crop loss. A dark headed green worm 13mm long moves between multiple berries in the cluster as they develop. Berries are webbed together and frass (appearing as wet sawdust) is deposited. The affected berries senesce early and drop to the ground. The larvae emerge and pupate in the ground over winter. In the spring the adult moths emerge as bushes are blooming. Small white eggs are laid in the calyx of the green berries. Within three days the larvae hatch and will remain on the outside surface of the berry for up to three additional days before tunneling into the fruit.</td>
<td>Pheromone traps are used to monitor the presence of the adult moth. The eggs (1mm) are oval, irregular, white when first laid becoming yellow with age. Normally the eggs are laid in the calyx of the green berry and can be observed with the naked eye or with the aid of a hand lens. To control, Effective insecticide must be applied while the egg and/or hatched larvae is on the surface of the berry. Spinosad is available in an OMRI approved organic control formulation.</td>
</tr>
<tr>
<td><strong>Blueberry Maggot</strong></td>
<td>Adult flies are 5mm in size. The most distinguishing feature is the dark “M” wing pattern. Flies also have a white spot on the back of the thorax and three (male) or four (female) white bands across the top of the abdomen. Flies emerge as midseason varieties begin to color. Flies feed and mate for 7-10 days before females are ready to lay eggs. Eggs are white, 1mm long, laid singly in the fruit. Maggots hatch in five days and begin feeding inside the berry. The maggot grows to 7mm. Infested berries become soft and shriveled. Mature larvae drop to the ground where they burrow into the soil to pupate.</td>
<td>This insect can be monitored using yellow sticky traps baited with ammonium acetate. Trap should be hung in the top 1/3 of the bush not touching foliage. Change bait regularly. Monitor traps daily. Control needs to begin within 7-10 day of catches to prevent egg laying activity. An effective insecticide must be sprayed as indicated.</td>
</tr>
</tbody>
</table>
### Suzuki Maggot (SWD)

Asian “Vinegar Fly”, *Spotted Wing Drosophila*, lays its eggs in healthy soft-skinned non-specific fruit. Fruit collapses soon after larvae begin feeding. It has a very short life cycle with multiple generations during the season. Populations can build rapidly. Late fruiting varieties most affected.

Presence of fly is monitored with vinegar baited traps to time insecticide control program. Selected control must conform to pre-harvest interval (PHI). Plant early fruiting varieties.

### Shaggy Beetle

Black, furry, fingernail size beetle, with light irregular spots. Adult beetle feeds on reproductive flower parts of blooming flowers. Can be epidemic in cyclic years. Non-specific pest.

Monitor presence. Organic control can be to trap out using floral scent baited traps. Cinnamyl alcohol mixed 1:1 with Trans-anethole works best, but either chemical agent can be used alone. Use of an effective insecticide not recommended as pollinating insects (bees) can be negatively impacted.

### Cockchafer

Large “May” beetle with cyclical peaks in population. Large white grubs feed on tender plant roots. Can devastate new plantings. Grubs remain in the ground feeding for three to five years.

An effective insecticide drench can be applied at base of plants. Organic control is available as predatory nematodes and soil fungi.

### Bud Mites

Tiny arthropod that lives and feeds inside fruit bud. Blueberry fruit buds will develop distinctive red blisters on injured tissues within two weeks of infestation. Continued feeding may kill the entire fruit bud.

Pruning out old canes will reduce bud mite populations. Two applications of an effective miticide one month apart immediately following last harvest recommended for control of severe infestations.

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Prepared by Richard A Dale, STTA-for DAI

USAID-ACED
MOLDOVA 11/15/2013
Annex B3
Best Practices for Blueberry Production

Rick Dale, STTA
USAID-ACED Moldova
November, 2013

SITE SELECTION & PREPARATION

1) A site with good air drainage (slope) will lessen incidence of fungal diseases and frost injury.
2) Protection from winter winds will lessen fruit bud desiccation and cold injury.
3) Coarse porous soils with high organic matter are best to promote vigorous root growth.
4) Well drained soils
   a) Surface-NO standing water after rain
   b) Internally-sub-soil rip hardpan if present or tile as necessary
5) Raised beds with added organic matter (sawdust or peat works well) should be considered where drainage is a problem.
6) Eradicate established perennial weeds and grasses using a well-timed application of Roundup® (glyphosate) before plowing.
7) Soil should be WELL WORKED in advance of planting and weed free.
8) 1-3 years of rotated cover crops will pay dividends:
   a) Rapeseed for fumigation of soil diseases and nematodes
   b) Buckwheat to inhibit weeds and increase organic matter
   c) Rye to starve out soil pathogens affecting dicots, to inhibit weeds, and increase organic matter
9) Install irrigation and have it operational BEFORE planting
10) Test soil to identify any corrections that might need to be made to balance fertility and pH
11) Blueberries require acidic soils. Amend soils to recommended pH 4.5-5.2.
   a) Added lime moves pH up.
   b) Added elemental sulfur moves pH down

CARE OF PLANTS BEFORE PLANTING

1) Purchase 2-3 year old container-grown plants from a reputable plant nursery.
2) Plant as soon as conditions permit.
3) The frost should be out of the ground and the threat of hard freezes past.
4) Late spring frosts will not hurt blueberry plants after they have been set out.
5) Do not allow plants to dry out
   a) If you cannot plant immediately, store your plants packed as they were shipped to you in a cool dark place.
   b) If it will be a week or more before you can plant, remove the plants from shipping
containers and set outdoors in a protected place.
c) Once pots are outside, irrigate daily

PLANTING

1) Plant only certified disease free plants from a reputable grower or nursery.
2) Plant in the spring as soon as the ground can be worked.
3) Highbush blueberry plants should be spaced 1.2m apart in the row. Rows should be spaced 3m apart.
4) Strip flower buds, flowers, and green fruit from the plants before setting in the ground.
   a) It is the root system you are seeking to establish in the first 2-3 years.
   b) Allowing the small transplant to fruit will divert strength from root development.
5) Separate the roots after removing plants from pots to prevent the plants from becoming root-bound.
6) Set plants 2-3cm deeper in the ground than the crown was growing in the nursery.
7) Firm the soil well around the plant after setting and irrigate immediately if it is dry.
8) Do not fertilize at planting time.
   a) You may side-dress the annual rate in mid-June
   b) OR wait to begin the fertilization program until spring of the second season.
9) Establish a non-invasive grass in the thoroughfare.
   a) A mixture of any of the following will work well: Perennial rye grass, timothy, bunch fescues, crested wheat grass.
   b) DO NOT seed in the row. Maintain a “clean strip” in the row one meter wide using hand weeding, mulches, and appropriate herbicides.

ANNUAL CARE

1) Keep the planting weed free.
2) Avoid cultivation as roots are easily cut and damaged.
3) Control weeds in thoroughfares with permanent sod culture.
4) Control weeds in the row with herbicides, mulches, and/or hand weeding.
5) Some herbicides may be approved for use on blueberries:
   a) Round-up® (glyphosate) post emergent broad spectrum--use with Mankar sprayer
   b) Devrinol® (napropamide) apply in dormant season spring or fall at 9kg per broadcast hectare.
   c) Fusilade® (fluazifop) only kills grasses and can be used in the row
   d) Callisto® (mesotrione) post emergence spray for annual broad leaf. Use before bloom
6) If herbicides are used, be sure to read and observe the label directions on the product.
7) Mulch heavily and hand weed in the row as necessary.
8) Mow between the rows as seed heads begin to develop in the thoroughfare grasses to
prevent re-seeding and invasion of grasses into the crop row.

9) Proper management of supplemental irrigation is critical:
   a) Blueberries are shallow rooted and benefit from frequent shallow irrigations
   b) The planting requires from 2.5 to 3.75 cm of water per week, either from rain or
      from irrigation during the season the plants are in leaf.
   c) Measure and record rainfall. Irrigate to make up the difference.
   d) Trickle or drip systems are preferred to overhead sprinklers which wet the entire
      plant and may aggravate disease problems.

10) NO pruning is required the first four seasons.

11) After the 4th season, Prune annually:
   a) Wood that is most fruitful is 2-5 years old
   b) Remove 2-3 of the oldest canes
   c) Thin new canes (one year canes) to 3-4
   d) The “ideal bush” will have 2-3 canes from each growing year through year five for a
      total of 12-15 canes.

12) Canes being removed should be cut as close to the ground level as possible or at point of
    attachment to a larger trunk.

13) Promote open well thinned bushes to allow sunlight and air flow to penetrate the bush.

14) Never head-back the bushes as this will eliminate crop in the year you hedge and
    promote dense top growth in following years.

CONTROL PEST AND DISEASES

1) Aphids and other "sucking" insects can be a vector for the spread of virus diseases and
   need to be monitored and controlled.
2) Fungi comprise a major group of blueberry diseases.
3) Any cultural practice that increases air flow, sunlight penetration, and reduction of
   moisture on plant surfaces will aid in the control of fungi.
4) Remove infected pruned canes from the field-- pile and burn to destroy pathogens.
5) Timely harvest will discourage bird presence and fruit damaging insects.
6) Consult competent agricultural extension resources for advice and detailed information
   before using pesticides.
7) Only use pesticides approved for use on blueberries —the label will indicate
   “blueberries” or “bush berries”
8) Apply pesticides with an “air blast” sprayer to assure complete coverage
9) Always read and abide by the product label.

NUTRITION AND FERTILIZATION

1) A periodic soil test (every 3-4 years) will identify imbalances and help to determine
   fertilizer rates.
2) Apply fertilizer in the spring:
3) Make “split” applications
   a) Apply 3/4 of the required annual rate at bloom
   b) Apply the remainder before July 1.
4) Band fertilizer in the row.
   a) When calculating area and required amounts of fertilizer, only consider the 1 meter wide strip of the crop row.
   b) There is no reason to feed the grass between the rows!
5) Do not apply fertilizers after mid-summer as this may reduce winter hardiness.
**BLUEBERRY ENTERPRISE BUDGET FOR MOLDOVA**

**ONE Hectare for FRESH MARKET/RETAIL-READY, hand harvest, values in USD**

Prepared by Rick Dale, 11/11/13

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<th>Item</th>
<th>year 1</th>
<th>year 2</th>
<th>year 3</th>
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**definitions**

- 3333 meters of blueberry row is equal to one hectare of blueberries.
- 0.34 kilograms blueberries is the net weight fruit of one clamshell
- 2.50 kilograms per meter of row equals blueberry yield.
- 3.00 kg per bush
- 833.25 kg per hectare equals blueberry yield.
- 6.00 equals wholesale price per kg (packed 340g clamshell).
- 24.48 per case (12 units) wholesale
- 28,351.98 equals annual net return after sixth year for one hectare
- 2.94 per 340g clamshell wholesale
- 3.06 per unit retail @ 50% mark-up
- 283,519.81 equals annual net return after sixth year for ten hectare.

**owned equipment for five hectare enterprise, 15 year life**

- 25,000.00 tractor: 25-40 HP, low profile, wide front, live PTO, width under 6 ft.
- 3,500.00 sprayer: 300 litre capacity minimum, airblast
- 2,500.00 mower: 4-6 ft., flail or rotary
- 3,500.00 tractor: 4-6 ft., flail or rotary
- 120.00 backpack sprayer
- 5,000.00 tillage equipment: plow, disc, harrow, cultivator
- 1,200.00 fertilizer spreader
- 534.92 optional: 2nd tractor with loader, two wheeled wagon/trailer

**other equipment for five hectare enterprise, 15 year life**

- 0.00 mulch spreader
- 37.00 BEI LBT harvester
- 63,775.00 packing line equipment
- 11,460.00 walk-in refrigeration

**overhead annual expenses for five hectare enterprise**

- 40,120.00

**labor: man-days requirements for one hectare**

- 83,265.00 kg total harvest
- 45,996.44 kg
- 2,100.00 walk-in refrigeration
- 1,200.00 100% spraying
- 25,900.00 owner labor compensation

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**An enterprise budget is not a business plan. The numbers presented here offer no guarantees for success. Actual outcomes will be affected by many factors, not the least of which is good management. As it is based on actual experience, values, and present conditions, the enterprise budget can be a powerful tool in the development of a good business plan. Its purpose is to reveal potential for profitability and return on investment. This enterprise budget makes several assumptions. It does not include costs for purchase or rent of land. It assumes that the operation shares some of the assets represented here with other or additional enterprise of the farm operation. In most cases, capital costs (with the exception of plant purchases) are prorated over an estimated life of the asset.**
In the start-up year, 55% of total costs are allocated for purchase of plants. 14% is allocated for establishment labor, 11% for field preparation fertilizer and soil amendments, 8% for management labor, and 6% for mulch. The plants will not begin to yield and provide a positive cash flow until the third season. The business is not expected to break even until the fifth season when production should be able to provide sufficient income to complete pay back the initial investments. Beyond the establishment year, budget allocation will shift increasingly towards labor. As the business approaches maturity in the sixth year, labor and packaging supplies will have emerged as the greatest annual budget demands. Although the enterprise budget as presented projects investment, expense, and income through year 15, the life of the planting, well managed on a good site, can provide return on investment for 50 years or more.
By the sixth year the plantation approaches maturity. From this time forward the total labor allocation (production, harvest, and management) represents 58% of expenses. Packaging, which includes plastic clamshells, labels, cardboard cases (or flats), and bulk sales containers, requires 29% of the expense budget. Although returns are excellent most years, the cash flow is distorted as is true with most seasonal farm enterprises. With the exception of harvest labor expense, most expenses occur in the early season ahead of the harvest. The farmer must either have cash reserves that can be drawn upon or a dependable line of credit to maintain a steady cash flow.
AGRICULTURAL COMPETITIVENESS AND ENTERPRISE DEVELOPMENT PROJECT

November 21, 2013

TRANSNISTRIA HONEY ROUND TABLE MEETING AND BEEKEEPER SITE VISITS

REPORT AND RECOMMENDATIONS:

ACED is currently making an assessment as to whether or not working with honey producers in the region of Transnistria would be worthwhile in creating income impacts in the remaining two years of the project. Before ACED can decide on possible appropriate interventions, the project needs to know if Transnistrian production technologies are within the range of acceptable and safe market requirements; if producers are open to improving and/or expanding their activities to enter new markets; what beekeeping/honey production techniques and practices could be improved by project interventions; and what future seminar topics could be offered by ACED that would address critical constraints and reveal new market opportunities.

ACED project staff, accompanied by Richard Dale DAI-STTA, spent a day in Transnistria meeting with honey producers and related industry participants, and touring beekeeping enterprises. A morning “Honey Round Table” was held with industry participants in Tiraspol to share the model of the consultant’s family-run honey production and marketing enterprise in Wisconsin, and to gain an insight into the current state of honey production in the Transnistrian region. 23 people attended the meeting, 5 of whom were women. We were told that an additional 7 people had intended to participate, but did not arrive due to problems with their automobile in route. The group was attentive to the introductory slideshow presentation, asking many questions during and following the program. The roundtable discussion that followed was lively and candid with full participation. In the afternoon, a tour was made to three representative honey production enterprises in the immediate area.

A snapshot of honey production enterprise in Transnistria

It was reported that there are approximately 65 beekeepers in Transnistria, of which 35 could be described as “very active”. Individual beekeepers maintain from 10 to 60 colonies of bees, with the average of number of colonies per farmer being approximately 25 colonies (families of bees). Most
of the larger beekeepers are moving their bees regularly to take advantage of seasonal nectar flows from seasonal bloom in specialty areas. The three most important nectar flows are from
1. spring blooming Acacia that occurs along the borders of forests,
2. mid-summer blooming buckwheat where it is grown as a “grain” crop,
3. late-summer blooming fields of cultivated Sunflower.

Transnistrian beekeepers are inclined to use the larger Russian hive and a “horizontal” management system, as opposed to the smaller dimensioned Langstroth hive preferred in the West. Full individual frames (combs) of ripe honey are regularly removed throughout the season for extracting. The honey filled combs will usually be those within the hive space on either side of the colony cluster. The emptied frames are returned to the hive the following day or are immediately replaced with empty comb frames. Most beekeepers will isolate honey if the floral source is identifiable, both as a tradition and as a means of adding value to the product by making it “unique” from undifferentiated honey. This management technique is possible due to the fact every flower has its season for blooming and because honey bees (apis mellifera) are selective foragers, i.e. they will collect from only one species of flower per flight and are drawn or directed to the most abundant and advantageous bloom available. Western beekeepers may also isolate different honeys, but are more inclined to remove whole supers (boxes) of frames which are collected over the top of the colony, rather than from individual frames side-to-side of the colony.

One of the larger producers (45 colonies) attending the meeting reported an annual yield in 2013 of 35-40 kilograms per hive. Comparing to well managed colonies in prime nectar producing regions of the world, this reported yield is respectable, and should be profitable, but is not outstanding. Another producer with 25 colonies reported a 2013 harvest of 124 kilograms per hive which is outstanding. If the numbers that were reported are at all accurate, a total annual honey production in 2013 for the Transnistrian region might be 129.2 Tons.

65 beekeepers managing an average of 25 colonies
= 1625 Transnistrian colonies
x 79.5 kilograms (average production per colony)
= 129,187.5 kilograms or **129.2 Tons of honey**

A significant amount of honey produced by the smallest beekeepers is consumed by extended family. Most sales are local, usually at the farm, and are repeat-customers or are customers referred by word of mouth. Little to no promotion of the product is done. Larger beekeepers complain that small beekeepers under-value their product making market-value pricing and sales by serious commercial beekeepers more difficult. Farm-gate prices are normally 40-60 MDL/kilo ($3.10 to $4.65 USD), less is charged to wholesale bulk buyers.
Other products of the hive that are collected, used, and/or sold in Transnistria are (in the order of importance to the beekeepers) wax, pollen, propolis, and royal jelly. Candles in the Orthodox tradition for use in religious observances must be beeswax. The later three products listed are dietary supplements or pharmaceutical in nature.

Production equipment is rudimentary, much of it self-made. Hives may have individual characteristics. Frames and other internal elements may not be interchangeable. Consequently, management of hives becomes highly individual, labor intensive, and time consuming.

Classification and grading standards for honey
Present standards may vary country to country. International honey standards are specified in a European Honey Directive and in the Codex Alimentarius Standard for Honey, both of which are presently under revision. USA voluntary standards for honey can be used as a general guideline for grading honey. It should be recognized that color and floral source are not factors in determining grade. Those factors which are considered in grading honey are 1.) Flavor, 2.) Clarity, 3.) Cleanliness or defect, and 4.) moisture content.

- **Grade A or Fancy**: fresh “natural” flavor and aroma true to floral source; nearly free of suspended material such as air bubbles, wax particles, or pollen grains; clean, and not more than 18.6% water.
- **Grade B or Choice**: good flavor and aroma, good clarity, clean, and not more than 18.6% moisture.
- **Grade C or Standard**: acceptable flavor, acceptable clarity, reasonably clean and free of defect, and not more than 20% moisture
- **Grade D**: substandard

Granulation
Honey can be an unstable supersaturated solution, i.e. there is often more dissolved dextrose in honey than can remain in solution. Honey granulates when the solution equilibrates: excessive dextrose is crystallized out of solution. Storage temperatures between 4.5-15.5°C and the presence of crystal nuclei promote and accelerate granulation. Straining, heating, and filtering honey retards the onset of granulation. A temperature of 60-65.5°C for 30 minutes is the most common treatment to dissolve crystal nuclei.

Fermentation
Fermentation is caused by the action of sugar-tolerant yeast upon dextrose and laevulose converting them to alcohol and carbon dioxide. Spoilage from bacteria does not occur due to the high acid content of honey. Fermentation caused by ordinary yeasts does not occur because these yeasts cannot grow in the higher sugar concentration of honey. Assume that yeasts are present in all honey. These yeasts are destroyed when honey is heated to 62.8°C for 30 minutes. Unheated honey will not ferment as long as it is kept stored below 11.1°C. Moisture content is relevant to fermentation: honey with over 17% moisture may, and over 19% moisture will, ferment.
Granulation usually precedes fermentation.

Storage of Honey
Honey should be stored in clean containers with tight lids. Low temperature storage prevents degradation: below 10°C for unheated honey, below 15.5°C for heated honey. Honey stored at temperatures above 26.7°C can deteriorate rapidly.

Honey preparations
Honey may be offered for sale in a variety of preparations:

- **Liquid** is extracted from the comb, strained or filtered, and heated to retard granulation and fermentation. This form is the most preferred in western retail markets because it is attractive and shelf-stable for a long period. It is usually sold in jars.
- **Granulated** is extracted and strained but not heated. It is preferred in Eastern Europe in part because granulation is “proof” that the product is pure honey and not adulterated with other sweeteners. “Granulated” is sometimes called “creamed” or “spread honey”.
- **Comb** may be “bulk” (full frames of capped honey), “cut-comb” (bulk comb cut into smaller pieces and packaged), or “sections” (cards) in which smaller surrounding Basswood (Linden) frames removed from the larger frame become the sales package.
- **Chunk** constitutes pieces of comb honey packed in jars surrounded by liquid honey.
- **Fermented Beverage** in western cultures is called “mead”, or if malted “bracket”. In Ethiopia where fermented honey beverage is a national specialty and tradition it is called “tej”.

Most Transnistrian honey is sold or consumed as “granulated”.

Recommendation regarding ACED Support for Transnistrian beekeepers
Transnistrian production technologies are within the range of acceptable and safe market requirements. Honey is a “consumer safe” product. Although it will ferment, it will NOT spoil. Bacteria cannot survive in honey. “Clean” conditions should be the norm for the preparation and packaging of honey products, but “sterile” environments, equipment, or packaging are not a necessity. Producers are expressing a need for market linkages. The larger producers would likely be open to improving and/or expanding their activities to enter new markets, as was evidenced by the large attendance and active participation in the recent ACED Honey Round Table meeting for Transnistrian honey producers. Significant changes would not be expected in the operations of most small “back-yard” beekeepers, whose interest is largely recreational and a desire for supplemental income. These smaller beekeepers, however, would likely participate in seminar and training events. Beekeeping/honey production techniques and practices that could be improved by project interventions might include:

- Understanding honey bee diseases and pests and the impacts on honey production.
- Implementation of safe management practices for the control of diseases and pests as these activities can affect the health of beekeepers, their families and honey consumers.
- Understanding the nature of honey and those factors affecting quality.
- Development of honey preparations, appropriate packaging, and labeling to be able to enter additional market channels.
- Proper pricing and marketing strategies for honey products.
- Introduction to new market linkages.
• Support and development of an active association of Transnistrian honey producers.

Critical constraints for Transnistrian honey producers that need to be addressed
• Insufficient market for their present production.
• Difficulty in crossing borders with bees or products
• Limitation of product offerings
• Inconsistent pricing practices that under-value the product
• Insufficient quantity of product to attract larger buyers
• Failure to meet minimum product requirements or standards to enter wider markets

Display of Moldovan honey in a major super market in Chisinau

950g Moldovan honey @ 85.6MDL
500g Imported honey
350g imported honey in tins

Prepared and submitted:
Richard A. Dale, STTA for DAI-ACED
Annex D

RHEI-VIT Strawberry and Raspberry Production Fields Report

AGRICULTURAL COMPETITIVENESS AND ENTERPRISE DEVELOPMENT PROJECT

November 19, 2013

SITE VISIT: RHEI-VIT strawberry and raspberry production fields, November 16

REPORT AND RECOMMENDATIONS:

RHEI-VIT is a Moldovan fruits and vegetables producer and processor of considerable capacity. Established as a State owned industry in 1945, it is has been privately owned and operated since 2001. Concentrated apple juice has been primary product since inception, however canned fruits and vegetables are a part of production and processing. Mr Rodion Gudim, Director for Raw Material Supply and Agriculture, requested a consultation regarding company production of strawberries and raspberries.

Presently, 2.7 ha of Strawberries are being cropped near the major plant site. All strawberry plants are Elsanta var. (Dutch) purchased as frigo from an Italian nursery. The strawberries were planted in three blocks in successive years from 2011. The production management implements double ribbon rows under plastic with drip irrigation. The natural soils are heavy clays, with poor internal drainage, and a pH of 8.0. The plantings are experiencing declining yields and vigour. 2013 production was 12T, down from 18T a year ago.

An attempt has been made to mitigate drainage and pH problems by mixing lighter soils from a distant site, with apple pressings from the factory, and acid peat imported from Belarus. The pH was only reduced to pH 7.0 in some areas of the planting as a result of this treatment. Strawberries prefer a soil pH of 6.0 to 6.5, in the slightly acid range. This is necessary to ensure uptake of adequate amounts of several trace elements and phosphorus that are more plant available in that pH range. A leaf sample from the RHEI-VIT plantings exhibited classic Iron (Fe) deficiency symptoms. Stress from heavy soils, poor drainage, and high pH is often a cause for deficient iron in plants. Iron is an essential element for the development of chlorophyll in the plant and consequent proper photosynthesis.

Adjustment of soil pH to this range is best done before planting. It takes some time to settle down the many chemical and biological changes that occur when soil pH is adjusted. Plants struggle to get certain nutrients before the new conditions become effective. Agricultural lime, preferably dolomitic lime, can be used to increase soil pH. Amendments should be made well in advance of planting.
To maximize growth and performance during the remaining productive life of the current plantings, at least two foliar treatments of chelated iron should be applied from the time the plants form leaves in the spring. The second application should be made two to three weeks following a first application. A description of a sample product with application rates and particulars is attached as an appendix to this report.

The RHEI-VIT strawberry fields are also not routinely protected from cold injury during the winter dormant season. Strawberry plants can be severely damaged when exposed to ambient temperatures of < -12°C. Cold injury will reduce vigour and yield. Cold injury can also increase stresses than can exacerbate other problems such as nutritional deficiencies. Managers should consider covering the entire field with clean loose straw to a depth of 10 cm. Straw is raked into the row middles after threat of hard frost has passed in the spring. In addition to providing winter protection, the straw left in the row middle during the growing season will reduce rain-splashed soil on developing berries, which is a major infection factor for Red Steele and other fungal diseases of the fruits.

1.0ha Raspberries are grown on a site distant from the plant site. Plants are all a Moldovan floricane bearing (summer bearing) variety and were planted in 2008. Row spacing and layout were appropriate to customary recommendations. The field is not conventionally irrigated; however tanker trucks bring water to the field during dry periods and flood the rows in a drive-by manner. Grasses and other weeds are not being controlled in the rows or in the thoroughfares. The planting lacks vigour. Few primocanes were thicker in diameter than a common pencil. Healthy raspberry canes should be the thickness of the human thumb, or greater. Reported yield was 0.5T. Yields should be >6T/ha for healthy fields. Lacks vigour. Less than pencil diameter canes.

If the planting is to be rejuvenated and salvaged for the remaining productive life, weeds in both the row and thoroughfares will need to be brought under control. Managers should consider either cleanly cultivated thoroughfares (preferred where the crop is not irrigated to recommendation), OR regular mowing of the existing grasses in the thoroughfares. If the mowing strategy is selected, the goal should be to prevent the existing cover from flowering or seeding. Round-up (Glyphosate) can be applied early in the season, close to the row on either side, using a shielded applicator to avoid over-spray onto the plants. If a registered pre-emergent herbicide is available for use in Moldova, such as Casoron (dichlobenil), Sinbar (terb避cil), or Princep (simazine); an early spring application can be made in the row according to label directions.

Prepared and submitted:
Richard A. Dale, STTA for DAI-ACED
### Annex E

**Consultant Activity Journal, Moldova-November 2013**

<table>
<thead>
<tr>
<th>Day</th>
<th>Date</th>
<th>Hour</th>
<th>Event</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>November 5</td>
<td></td>
<td>Outbound-Travel</td>
<td>Duluth to Chisinau</td>
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<tr>
<td></td>
<td>Tuesday</td>
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<tr>
<td>2.</td>
<td>November 6</td>
<td></td>
<td>Outbound-Travel</td>
<td>Legrand hotel Chisinau</td>
</tr>
<tr>
<td></td>
<td>Wednesday</td>
<td></td>
<td>Arrive. Check into hotel</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>November 7</td>
<td>9:00 AM</td>
<td>Sit in on USAID meeting with Charlie Davis and five Moldovan agriculture leaders: Discussion of direction of activity for ACED for remaining two years of mission</td>
<td>ACED Office Kentford Office Center Chisinau</td>
</tr>
<tr>
<td></td>
<td>Thursday</td>
<td>2:00 PM</td>
<td>Meet Mr. Tarai Iurii for introduction to his plans to develop a blueberry plantation: Lolly Berry</td>
<td>Hotel</td>
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<td></td>
<td></td>
<td>10:00 PM</td>
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<tr>
<td>4.</td>
<td>November 8</td>
<td>All day</td>
<td>Visit site for Lolly Berry blueberry development west of Chisinau.</td>
<td>west of Chisinau</td>
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<td></td>
<td>Friday</td>
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<tr>
<td>Date</td>
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<td>Activity</td>
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</tr>
<tr>
<td>November 9</td>
<td>All day</td>
<td>Prepare materials: • Blueberry enterprise budget template. • Blueberry best practices. • ACED final report template</td>
<td>Office at Hotel, Chisinau</td>
<td></td>
</tr>
<tr>
<td>November 10</td>
<td>OFF</td>
<td>Attended National Ballet theater</td>
<td>MHI, Chisinau</td>
<td></td>
</tr>
<tr>
<td>November 11</td>
<td>AM</td>
<td>Meet with Dr Parascovia at Moldovan Horticultural Institute • President of “Bacifera”, the Moldovan National Berry Producers’ Association • Sought inclusion for blueberry varieties in catalogue of allowable plants for production in Moldova • Discussed cooperation for evaluation tours of CIS zone for HV crops consideration</td>
<td>MHI, Chisinau</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PM</td>
<td>Meet with Iurii regarding Lolly Berry farm business development • Discussed land preparation • Interpreted soil tests • Evaluated variety selections • Planned layout and plant spacing • Evaluated Polish nursery offer • Prepared enterprise budget</td>
<td>ACED Office</td>
<td></td>
</tr>
<tr>
<td>November 12</td>
<td>AM</td>
<td>Work on Lolly Berry enterprise budget • Work on Blueberry IPM disease and pest guidelines</td>
<td>ACED Office</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PM</td>
<td>In the field. Visited three berry production sites in/near Jora de Jos CIS region near the Nistru River a. Arbustina Cold Storage, Oleg Zaharia: Vertically integrated distributor/packer/producer o Cold storage developed 2011. Modern high-tech refrigeration units, New building still needing some competition (aggregating shipments on open-air dock where produce awaits final loading) o 1600T capacity with 4x200T and 8x100T cold rooms o Refrigeration and freezing</td>
<td>Jora de Jos</td>
<td></td>
</tr>
</tbody>
</table>
capabilities
  o Will add a sort/pack line for tree fruits (apples, etc.)
  o Excess capacity. Buys some local production, handles his own production, imports non-domestic product (e.g. bananas, pineapple, etc.)
  o Distributes primarily local (domestic), but also to markets in Ukraine, Belarus, Russia, and small amounts to Romania
  o Poor sanitation—would not sustain USDA GAP/GHP audit without substantial upgrades.
  o Field Production began 2005. Sells as “organic” but not certified. Not in CIS zone but has improved his own capacity for irrigation and will expand the system
  o 15ha red raspberry (down from 25ha in 2005—seeks to replace) cropping Polana on both primocane and floricanes. Also a Russian variety, Creposh. Plantings appeared depleted, stunted, lacking density and vigor, choked with grass and weeds. Fruit packed in field to 600g clamshells x4/case. Moved to 1C cold room in 1-2 hours. Shipped to markets within 12 hours. Price paid 2013=2.00€/kilo
  o 4ha strawberry: Triple ribbon row management without plastic mulch
  o 1ha gooseberry
  o Yields: 7-8T/ha 2011, 3-4T/ha 2012 and 2013 (drought)
  o Capacity to expand, Constraints are labor and water

b. Ion Voica, President of Water Users Association for Jora de Jos command area.
  o Plan for 1 ha strawberry and raspberry development.
  o Immediately adjacent to CIS pumping/ponding station
  o Beautiful field: just plowed. Recent rotations of corn/alfalfa/cereal grains. Loam soils. pH not tested = probably about 7.0

c. #2 farmer, small day-neutral strawberry plots (lunch at his home)
<table>
<thead>
<tr>
<th>10.</th>
<th>November 14 Thursday</th>
<th>All day</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>In the Field. Visited three sites in/near Cosnita, Criuleni CIS regions near the Nistru River.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Mr. Gavzilou Tzojim, Executive Director of Agricultural Producers Association. Two CIS systems: One serving 2 communities with 700ha. May link to a 3rd community with an additional 300ha. Second serving 3 communities with 800ha</td>
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<tr>
<td></td>
<td></td>
<td>o 17ha blackberries damaged by drought</td>
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<td></td>
<td></td>
<td>o Many potential investors for strawberry/raspberry production</td>
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<td></td>
<td></td>
<td>o Strawberry disease problem (Fusarium) a significant constraint—lack registered control (Fudasol?)</td>
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<td></td>
<td></td>
<td>• #1 “New” farmers (didn’t get names)</td>
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<td></td>
<td></td>
<td>o Small “greenhouse” production of day neutral strawberries (smaller portion = 100 plants Albion)</td>
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<td></td>
<td></td>
<td>o Most are Russian variety of shared plants from neighbors</td>
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<tr>
<td></td>
<td></td>
<td>o Irrigated double ribbon rows</td>
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<tr>
<td></td>
<td></td>
<td>o Sanitation issues with toilet and poultry</td>
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<td></td>
<td></td>
<td>o Short term enterprise as implemented as here is no apparent capacity for rotation.</td>
</tr>
</tbody>
</table>

Cosnita
Fusarium will become limiting factor

- #2, small farmer
  - Small plots of raspberries, blackberries, strawberries
  - Provided raspberry pruning presentation and demonstration

- #3 New farmer: nearer to Chisinau and outside CIS zones
  - 3.6ha family operation (Father working in Germany, older brother, and the brother interviewed is a horticulture student in Chisinau)
  - Grapes, raspberries, blackberries, strawberries
  - 2 and 3 year old plantings of berries. Grapes more established. Plantings looked sparse, stressed, weed choked, lacking vigor. Irrigation hauled up to this hilltop site in barrels to fill water tank. Gravity flow drip on berries.
  - Innovated unique small tillage equipment.
  - Young man expressed confidence and commitment for the enterprise
  - Marketing fresh daily to Chisinau markets

11. November 15 Friday All day Completed blueberry pest and disease IPM list Tweaked Moldovan BB enterprise budget ACED Office, Chisinau
### 12. November 16 Saturday

**All day**

In the field: Rhei-Vit, fruits and vegetables processor and farms. Mr Rodion Gudim, Director for Raw Material Supply and Agriculture

- Vertically integrated business of considerable capacity
- Established 1945 as a State owned industry
- Privately owned by Moldovan/American interest since 2001

**2.7 Ha Strawberries.** All Elsanta var. (Italian). Planted in three blocks in successive years from 2011... Plan is to crop three years and remove. Double ribbon rows on plastic. Irrigated.

- Declining yields and vigour
- Clay soils with drainage problems. pH 8.0. Have attempted to mitigate problems by mixing lighter soils from distant site with apple pressings and peat imported from Belarus. Only moved pH to 7 in some areas.
- 12T down from 18T
- Leaf sample showed Fe deficiency. Treat with Chelated Iron foliar spray.
- Strawberry crowns subject to injury at temperatures < -12C. Should consider winter straw cover.

**1.0ha Raspberries.** Moldovan floricane bearing variety.

- Planted 2008. Lacks vigour. Less than pencil diameter canes
- No irrigation other than flooding from tanker trucks
- Sodded-in. No thoroughfare management.
- 500 k/ha yield

Promised report with recommendations.

### 13. November 17 Sunday

**OFF**

### 14. November 18 Monday

**All day**

Blueberry Raspberry Enterprise Conference with Parascovia

- Approximately 30 registered attendees
  - Blueberry Potential, R Dale
  - Experiments with Blueberry, Sava Periscovia
  - Blueberry Establishment, R Dale
  - Raspberry Culture, Sava Periscovia
  - Raspberry Production for Fresh Markets, R. Dale

ACED Conference Room, Chisinau

### 15. November 19 Tuesday

**All day**

Office

- Develop beekeeping program
- Research
- Completed Lolly Berry Farm report

ACED Office, Chisinau
<table>
<thead>
<tr>
<th>Date</th>
<th>Activity</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>November 20</td>
<td>All day</td>
<td>Office,</td>
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<tr>
<td>Wednesday</td>
<td>Research</td>
<td>Chisinau</td>
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<td></td>
<td>Work on Final Report</td>
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<td>16.</td>
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<tr>
<td>November 21</td>
<td>All day</td>
<td>Beekeepers Round</td>
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<tr>
<td>Thursday</td>
<td>Research</td>
<td>Table</td>
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<td></td>
<td>Work on Final Report</td>
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<td>17.</td>
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<tr>
<td>November 21</td>
<td>All day</td>
<td>HVF Honey Operations, Ppt</td>
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<tr>
<td>Thursday</td>
<td>Beekeepers Round Table</td>
<td>Presentation</td>
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<td></td>
<td>Research</td>
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<td></td>
<td>Work on Final Report</td>
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<td>Tiraspol,</td>
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<td></td>
<td></td>
<td>Transnistrian Region</td>
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<td></td>
<td>Visit beekeeping operations</td>
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<td></td>
<td></td>
<td>Sucleia</td>
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<td></td>
<td></td>
<td>Bendery</td>
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<tr>
<td></td>
<td>• Small back-yard apiary</td>
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<tr>
<td></td>
<td>o 10 hives</td>
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<tr>
<td></td>
<td>o 64 year old retiree seeking recreation and supplemental income</td>
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<td></td>
<td>• 45 hive Operation</td>
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<td></td>
<td>o Former ship yard steel worker</td>
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<td></td>
<td>o Builds all his own equipment</td>
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<td></td>
<td>o Modified truck mobile apiary</td>
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<td></td>
<td>o 35-40 kilos/hive</td>
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<td>• Needs more market for present production</td>
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<td></td>
<td>o 25 Hive operation</td>
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<td></td>
<td>o 124 kilos/hive</td>
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<tr>
<td>November 22</td>
<td>All day</td>
<td>Blueberry Raspberry Enterprise Conference</td>
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<tr>
<td>Friday</td>
<td>Blueberry Raspberry Enterprise Conference</td>
<td></td>
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<td></td>
<td>• Approximately 23 registered attendees</td>
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<td></td>
<td>o Blueberry Potential, R Dale</td>
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<td></td>
<td>o Blueberry Establishment, R Dale</td>
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<tr>
<td></td>
<td>o Raspberry Production for Fresh Markets, R. Dale</td>
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<tr>
<td></td>
<td>o Top 20 Blueberry Varieties, R. Dale</td>
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<td>Chitcani,</td>
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<tr>
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<td></td>
<td>Transnistrian Region</td>
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<tr>
<td>November 23</td>
<td>All day</td>
<td>Report writing</td>
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<td>Saturday</td>
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<tr>
<td></td>
<td>• Completed honey report</td>
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<td>• Worked on Final Report</td>
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<td>19.</td>
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<td>Office at Hotel.</td>
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<td>Chisinau</td>
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<tr>
<td>November 24</td>
<td>OFF</td>
<td>meet with Jim and</td>
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<td>Sunday</td>
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<td>David Pricha</td>
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<td>November 25</td>
<td>Homebound-Travel</td>
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<td>Monday</td>
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