Farm Management Plan
Organic Research Farm
West Virginia University

INTRODUCTION/FARM HISTORY

February 1915, in a bid to keep the University located in Morgantown, WVU president Trotter encouraged Monongalia County to raise $75000 for land purchases for the college of agriculture. The legislature then approved funds for new buildings, including the College of Agriculture building (Olgebay Hall), and the university remained in Morgantown. The farm of C.R. Wilbourne, 62.67 acres, was purchased for horticulture ($9400) in 1916.

Since its purchase the farm has been host to a variety of research projects. These projects have included work with tree fruits, blueberries, strawberries, brambles, potatoes, vegetable crops and grapes. The disciplines of horticulture, plant pathology, entomology, and soil microbiology have been involved with these projects over the years. The farm housed a greenhouse in the 1960's and 1970's. The new farm barn/office building was built in the 1980's.

FARM LOCATION/MAPS

MAP 1- Location

The farm consists of acres in the mileground area of Morgantown, WV. The farm entrance is miles from the intersection of Route 119 and Route 705.

MAP 2- Research areas

The research area consists of 0.9 acre for the market garden, 0.9 acre for each of Blocks 1& 3 in the field crop/grazing, 0.6 acre for Block 2 of the field crop/grazing study and an additional 6 acres for pasture and hay production. This gives a total research area of 9.3 acres.

MAP 3- Additional and Adjacent uses

Additional land uses include apple orchard (3.2 acres), brambles/grapes (1.3 acres), blueberries, American hollies, Oaks, landscape ornamentals, various plant species for mite study (Dr. Amrine), an area for forensic entomology (Dr. Amrine), honey bee hives, open field areas, and wooded areas.

MAP 4- Market garden layout

Market garden research plots will be arranged for a rotation of Legumes (peas and beans), Solonaceae (tomatoes and peppers), Curcurbits (pumpkins and squash), Compositae (spinach and lettuce), and cover crops (rye/vetch). Alleyways between growing plots will be established and maintained with Kentucky Bluegrass and white clover.

MAP 5- Field crop/grazing layout

The field crop and grazing study will consist of 3 blocks of 22 plots. Eight of the 22 plots will be assigned a four year rotation of crops without animal grazing. The remaining 14 plots will include 8 plots for the four year rotation and 6 plots for pasture grazing.

CURRENT RESOURCES

SOILS

The soils on the farm are of the Dormont, Guernsy, and Tilsit series. Most of the research areas have slopes ranging from 0-8%. (MAP 6)

The Dormont and Guernsy series are describe together because they have no major differences in use or management. For both the surface layer is 9-10 inches thick and the subsoil is 34-35 inches thick. The depth to bedrock in both soils is 48 inches or more. The available water holding capacity is high. While permeability is moderately slow to slow. Runoff is considered medium and the natural fertility is moderate to high. Both soils have a seasonal high water table at about 1.5 to 3 feet below the surface. Where unlimed the soils are acid to moderately acid. These soils are suited to cultivated crops and to pasture and hay. The hazard of erosion is moderate in unprotected areas and is a management concern. If these soils are farmed, cultivating on the contour, using a rotation that includes hay crops, and returning crop residue to the soil help control erosion and maintain fertility and tilth.

The Tilsit series has a top layer of 7 inches and a subsoil of 35 inches. The depth to bedrock is about 56 inches. Available water capacity is moderate and permeability is slow in the firm part of the subsoil. There unlimed the soil is strongly acid to extremely acid. The soil has a seasonal high water table about 1.5 to 2.5 feet below the surface. The soil is suited to cultivated crops and to pasture and hay. The hazard of erosion is moderate in unprotected areas and is a management concern. Cultivating on the contour, using a rotation that includes hay crops, and returning crop residue to the soil help control erosion and maintain fertility and tilth. The deferment of grazing in the spring until the soil is firm and the bare areas are seeded are major pasture management considerations.
(source Soil Survey of Marion and Monongalia Counties, West Virginia)

BUILDINGS

There are two structures on the site that belong with the farm. The main building houses four garage bays, an office, lunch room, restroom, tool storage room, and individual cage storage areas for professors with research areas on this farm. This building is equipped with electricity, heat and water service. The first aid kit is located in this building as is the phone.

The second structure is an open fronted storage building. This building currently houses the large Cass tractor and various implements for use with this tractor. There are also a few pieces such as an old pickup truck which require major attention before they would be functional. Also housed in this building are various vehicles, ie. boats, used by the division of Forestry and Wild life management. This building is equipped with electricity.

There is also a building belonging to WVU Physical Plant located adjacent to Block 2 of the field crop/grazing project. This building is surrounded by various stock piles of equipment and supplies used by physical plant around the University.

EQUIPMENT

ORGANIC FARM

- Cass David Brown 995 tractor
- Tiller (rebuilt)
- Trailer
- Sprayer (G257CP, one useable, one for parts))
- Fertilizer spreader with discs
- Strawberry hill makers (discs)
- 12" power auger for PTO
- Truck (clutch slips)
- Fork Lift (needs front gears and chains worked)
- Massey Ferguson 245 tractor (rebuild mower deck each year)
- Brush hog
- Hand tools: large (grain) shovels – 3
  - Step ladder – 1
  - Straight ladders – 3
  - Pitch forks – 2
  - Push brooms – 2
  - Sythe – 1
  - Straight rakes – 3
  - Edging shovel (straight blade) – 1
  - Weed slings – 2
  - Hoe – 1
  - Pruning: 3 loppers
    - 2 pole pruners
    - 2 saws
  - Hand saws – 2
  - Bulb planter
  - Axes – 2
  - 2 scales – large
- 2 backpack sprayers
- Welding Equipment
- Drill press and grinder
- Dr. Bryan's 2 shovels and sledge

AGRONOMY FARM

- Small brush hog
- Small (Kubota) disc
- Dr. Bearce's walk-behind tiller and sickle bar mower
- agronomy walk-behind sickle bar mowers
- old hay bailer
- grain (alfalfa) planter and embedder to follow planting
- haying equipment:: side bar mower and wind rower
- Mower walk-behind (have bag?)

REEDSVILLE FARM

- Potato planter
- Potato harvester and grader

LABOR
The farm manager spends only part of his schedule on this farm and the remainder on the Agronomy farm. There is one full time farm worker on this farm. Other labor is relocated temporarily for the completion of special projects or tasks, such as plowing and discing. One full time research assistant is responsible for working with the organic research for time and work management, data collection, day to day operations, and management paperwork.

WATER
The water to the market garden for irrigation and for the livestock is Morgantown municipal water. This water is treated with floride as is standard municipal practice. The governing agency for the water service is the Morgantown Utility Board. The office is located 278 Green bag Road, Morgantown, WV 26505. The phone number is 292-8443, nights – weekends – holiday emergencies 296-4322.

FUNDING
Northeast Regional Sustainable Agriculture Research and Education Grant (SARE)

MISSION STATEMENT

ORGANIC SYSTEMS RESEARCH PLAN
(SARE grant)
RESEARCH OBJECTIVES: To compare intensive cover cropping and use of compost as methods to convert market gardening and field crop/livestock farming from conventional to organic.

APPROACHES AND METHODS: In 1999 the entire farm will begin the transition to organic managements and will be available for a variety of research projects. The following methods will describe a balanced mix of farming systems research and component research to efficiently characterize key transition practices.

FARMING SYSTEM RESEARCH: Two replicated farming systems experiments, market garden and field crop/grazing, will be conducted. Each will compare two treatments for managing soil quality during the transition from conventional to organic practices: a low input transition using cover crops only and a high input treatment using off-farm compost amendments with cover crops.

MARKET GARDEN LOW INPUT TRANSITION: In Spring 2000 the rye/vetch sown in Fall 1999 will be turned under. The plots will then be sown with soybeans. These will be tilled under in the late summer and a fall planting of rye/hairy vetch will be planted. These are considered green manure crops and will

produce no saleable product for the 2000 season. In spring 2001 the rye/hairy vetch winter cover crop will be plowed under and a four year rotation will be initiated using Legumes (peas and beans), Solonaceae (tomatoes and peppers), Curcurbits (pumpkins and squash), Compositae (spinach and lettuce).

MARKET GARDEN HIGH INPUT TRANSITION: In Spring 2000 the rye/vetch sown in Fall 1999 will be turned under. Then compost and recommended fertilizers will be tilled in. This compost will come from the WVU Animal Sciences farm composting system and will contain approximately 1 part dairy cow manure and 1 part shredded leaves. The compost was mixed in May 1999 and placed in exposed windrows on the Animal Sciences Farm. This mixture, since it has completed composting, will be transported and applied to the market garden and field crop/grazing plots in March of 2000 as the weather permits. In February 2000 hay was transported from the Reedsville Farm to be added to a second windrow of compost which consists of 1 part cow manure and 1 part wood chips. The row will be remixed with the hay, for a 1 part manure, 1 part wood chips and 1 part hay mixture, to restart the composting process within the row. This material when completely composted will be transported to the Organic Farm in Summer of 2000 for application to the plots in the Fall, weather permitting.

The four year rotation of Legumes (peas and beans), Solonaceae (tomatoes and peppers), Curcurbits (pumpkins and squash), Compositae (spinach and lettuce) will be planted. The tomatoes, peppers and lettuce will be started in the WVU greenhouse and transplanted to the market garden. All other crops will be direct seeded. These plots will be managed for the highest possible yields this first year. Following the final harvest on these plots they will be planted to the rye/hairy vetch winter cover crop. In the year 2001 and 2002 the cover crop will be incorporated into the soil and the same rotation sequence will be followed for these plots.

FIELD CROP/GRAZING LOW INPUT TRANSITION (Treatment 1): In spring 2000 the plots will be sown with soybeans. These will be tilled under in the late summer and a fall planting of rye/hairy vetch will be planted. These are considered green manure crops and will produce no saleable product for the 2000 season. In spring 2001 the rye/hairy vetch winter cover crop will be plowed under and a four year rotation will be initiated using soybeans, potato, wheat, and Brussels sprouts. One harvest for each crop will be collected this season. Plots will be immediately planted to cover crop after harvest. In fall 2001 the remaining plots will again be planted to a rye/hairy vetch winter cover crop. In spring 2002 this cover crop will be plowed under and the four year rotation continued with appropriate multiple plantings and harvests. This year the cover cropping will only occur in the off-season.

FIELD CROP/GRAZING HIGH INPUT TRANSITION (Treatment 2): In spring 2000 the high input plots will receive compost amendments at a rate of 10 tons/Acre. This compost will come from the WVU Animal Sciences farm composting system and will contain approximately 1 part dairy cow manure and 1 part shredded leaves. The manure and leaves were mixed in May 1999 and placed in exposed windrows on the Animal Sciences Farm. This material will be added to the plots in Spring 2000 for the first growing season. For each additional application compost with the approximate content of 1 part manure, 1 part wood chips and 1 part hay will be used. In February 2000 hay was transported from the Reedsville Farm and added to an existing windrow. The row was then mixed to start the composting process within the row. This material will be transported to the Organic Farm in summer 2000 for application to the plots in fall, weather permitting. The four year cropping sequence will be followed, same as the 2001 low input sequence using soybeans, potato, wheat, and Brussels sprouts. These plots will be managed for the highest possible yields this first year. Following the final harvest on these plots they will be planted to the rye/hairy vetch winter cover crop. In the year 2001 and 2002 the cover crop will be incorporated into the soil and the same rotation sequence will be followed for these plots.

MONITORING PROGRAM: Soil pesticide residue analysis will be performed on soils samples collected in Fall 1999 and held a 0C until they will be shipped to WV Department of Agriculture for analysis in Spring 2000. The soil will be measured before plowing and once each year after the last harvest has been taken in the fall for hydraulic conductivity, bulk density, aggregate size distribution, aggregate size stability, particle size and particle density. The soils will also be measured for organic matter content, organic nitrogen, inorganic nitrogen, pH, conductivity, ion suite – exchange phase, macronutrients (P, K, Ca, Mg), micronutrients (S, Cu, Mn, Zn, Fe, B, Cl, Mo), ion suite – solution phase, cation exchange capacity, anion exchange capacity, contaminant and other ions (Cd, Ni, Pb, As, Na, Se, Co). Soil biological activity and biotic community structure will be measured by monitoring soil invertebrates, focusing on earth worm fauna, plant parasitic nematodes, and nematode community structure.

SUPPLEMENTAL STUDIES:
COMPOST APPLICATION RATES: A series of small plots will be established to measure soil changes in response to differing compost application rates. The plots will be established in Spring 2000 in an area to the north of the market garden plots. Weekly measurements will be made during the growing season and every two months thereafter for hydraulic conductivity, bulk density, aggregate size distribution, aggregate size stability, particle size and particle density. The soils will also be measured for organic matter content, organic nitrogen, inorganic nitrogen, pH, conductivity, ion suite – exchange phase, macronutrients (P, K, Ca, Mg), micronutrients (S, Cu, Mn, Zn, Fe, B, Cl, Mo), ion suite – solution phase, cation exchange capacity,

anion exchange capacity, contaminant and other ions (Cd, Ni, Pb, As, Na, Se, Co).. This intensive sampling is needed to assess the dynamic temporal changes in soil fertility statue associated with organic matter additions.

These plots will be planted with carrots (*Daucus carota sativus*).

These plots will also be used to evaluate mulching systems. One group of 16, 10'x10' plots that receive the compost rates will also be planted with Zucchini Bush Summer Squash to evaluate mulching with either straw or buckwheat hulls (both over newspaper) and the effects on squash bugs. The use of row cover or no row cover for effects on cucumber beetle (and bacterial wilt), squash bug, and squash vine borer. The squash will be direct planted (when days 70-75F, nights 60-65F), mulched, and covered with floating row covers. The row covers will remain on until the male flowers appear. The plots will be seeded with 60 seeds (4 rows with 15 seeds 6" apart) for germination rate and percentage measurements. The resulting plants will be thinned to 15 plants per plot (24" x 36" spacing). The time to first harvest will be recorded and data will be collected over the season for the number and weight of the fruit harvested. The plots will be monitored for cucumber beetle, squash bug, and squash vine borer presence as well as resulting plant damage.

WEED MANAGEMENT ALTERNATIVES: A series of small plots, to the south of the market garden, will be established with the cover crop (low input) and the compost (high input) soil amendments. The subplots will then receive either the untreated control, minimum cultivation, intensive cultivation/hand weeding, 5 cm of hay mulch, 10 cm hay mulch, or 20 cm of hay mulch. These treatments will then be assessed for weed biomass, weed community, and treatment costs.

OTHER RESEARCH OPPROTUNITIES

IPM: In the orchard which has received minimal management in the past 2 years, the effect of ground cover up to the trunks will be analyzed for it's impact on insect habitat. Randomly chosen trees, apple, will have the ground cover removed from the area surrounding the trunks by hand pulling those directly next to the tree. Then using a propane torch a ground cover free 4' ring will created around the trunks. In this ground cover free area emergent traps will be place to monitor the adult insect population as they emerge from soil overwintering sites. There will also be emergent traps placed in similar locations under trees that have not had the ground cover removed. The orchard will also be monitored with aerial traps for flying insects and on site inspection of leaves for pest management decisions to be made. The plum curculio is a major pest for apples of our region with limited agents. To monitor the migration of this pest into the orchard from the surrounding wooded areas in the spring, a series of traps will be

constructed and placed along the perimeter of the orchard next to the wooded area.

IPM: Small plots will be established at random sites around the farm to evaluate the beneficial insect population. These plots will be planted with either a commercially available plant mixture for beneficial insect habitat or a more limited herb mixture of dill, fennel, nasturtium, caraway, and chervil. These plots will be located outside of the market garden and field crop/grazing research area. The plots will be prepared and seeded in May 2000. Beginning in June 2000, sticky cards will be placed within the plots for 48 hours in the last week of each month. These cards will be collected for the months of June, July, August, September, and October in the years of 2000, 2001 and 2002.

There will also be a series of sticky cards, yellow and blue, located along the market garden and field crop/grazing research area in a manner such that the migration of insects into the research areas can be monitored. The cards will be replaced weekly throughout the 2000 growing season. (see Appendix 2 for record sheet)

OTHER AREAS: Other research options are available on land that is not currently under development with this grant, so long as it is done in a manner fitting with organic certification process requirements we are following.

MANAGEMENT PLAN
FIELD CROPS/PASTURE

The field crop/pasture study will have 22 plots per block. Eight of these will receive compost amendment and be planted the first year, year 2000, into the four year rotation of crops. The rotation will be soybean followed by wheat followed by Brussels sprouts followed by potatoes and then soybeans again. Three of the plots will receive the compost amendment and then be planted with orchard grass/red clover. The remaining 11 plots will be for the low input treatment. Eight of them will be planted to a cover crop of rye/hairy vetch. And three will be planted directly to the orchard/red clover.

CROP DESCRIPTIONS

BRUSSELS SPROUTS
Brassica oleracea gemmifera

Cool season crop, that has the optimum temperature range of 1-18C (34-64F). The optimum monthly temperature is 60-65F with a minimum of 40F and a maximum of 75F.

The cabbage family are heavy feeders and benefit from high applications of compost/manure. Look for a pH range of 6.0-7.5 in a well drained soil. They like high N (Side dressing traditional), 0.5+ ppm B and no Mo deficiency. The cabbage family is also sensitive to increased atmospheric SO_2. Keep adequate water to the field. Protect seedlings (especially in the cotyledon stage) from Flea Beetles.

For a spring crop use transplants. For late spring/early summer can direct seed. For fall crop direct seed with ½ -1 ½ lb/A seeding rate. Brussels sprouts have about 9000 seed/oz or 320 seed/g. If spaced at 18" in row x 36" between rows, 9680 plants/A.
Traditional spacing can be 18-24" in row, and 24-40" between rows.

VARIETIES
Long Island Improved – old standard open pollinated variety

SCHEDULE
For transplants (Frost free date ~May 15)

For direct spring seeding

HARVEST
Europe: after the sprouts have begun to form, they remove the terminal shoot tip and the lower leaves. They harvest the sprouts from the bottom up as they reach 2 ½ - 4 cm (1- 1 $^3/_4$") in diameter, are firm, the a bright appearance and a good color.

California and England: they harvest the entire plant and strip the sprout at the packing house.

Vacuum cooled to 2C and top iced or 0C for upto 5 weeks, store with 90-95%RH, 5-7% CO_2 and O_2.

INSECT PESTS
Flea Beetles
Root Maggots
Cabbage Worm
Cabbage Looper

Diamondback catepillar
Thrips (when dry)
Aphids

DISEASES
(follow strict sanitary cultural practices)
Black rot
Black leg (hypocotyls and cotyledons)
Damping off
(the above 3, can treat seed with hot water, but will also have lower germination rates)
Club root (pH lower than 7.1)
Fusarium yellows (warm temps, resistant varieties)
Bacterial soft rot
Alternaria leaf spot (wet rainy)
Edema

IPM PLAN
Scouting for aphids and foliage feeding caterpillars

Visual inspection of leaves on 5-10 plants chosen randomly will be done once or twice weekly. For each plant a record of live caterpillars present, the species, and note of infestation or clean (see record sheet Appendix 2). Infestation levels should be below the following levels.

Plant stage	%
Seedbed	10%
Transplant to axillary bud formation	30%
Bud enlargement	20%
Mature Sprouts	10%

When the infestation exceeds these levels, the plants will be treated with *Bacillus thuringensis kurstaki* or *aizawai* (Agree, Biobit, Cutlass, Dipel, Javelin, etc). Thorough coverage is important because the Bt kills only the larval stages and works best on young caterpillars.

The presence of aphids will also be recorded. If aphid colonies are present the plants will be sprayed with insecticidal soap, unless paratisation is detected. If beneficials are working, then the population of aphids will be monitored for several consecutive days to guarantee the control levels. Aphid control is particularly important in the seedbed stage. . May order and release aphid midges, lady beetles, lacewings, or parasitic wasps. If outbreak is severe and soap does not work to gain control, spray with pyrethrin, sabadilla, or rotenone (Last resort only).

(Source – University of Illinois, Dept. of Crop Science)

Flea Beetles – Adults are black, brown, or bronze 1/10th " beetles with well developed hind legs and jump like fleas when disturbed. The larvae are thin, white, legless grubs and live in the soil. Adult feeding creates shot hole effect on foliage. The adults can overwinter in the soil, emerge in spring, feed, and lay eggs on the plant roots before dying. Eggs hatch in 1 week. The larvae feed for 2-3 weeks and then pupate in the soil. The new adults emerge in 2-3 weeks. One to four generations are possible in a season.

OTHER BRASSICAS

Cabbage, cauliflower, broccoli, kale, collards, kohlrabi, bokchoy, Chinese mustard, celery, mustard (pak choi), rutabaga, turnip, and rapeseed for forage.

NOTE

Companion planting for the cabbage family, book Carrots love Tomatoes, can use hyssop, thyme, wormwood, and southern wood for repelling the white cabbage butterfly. They can benefit from planting with celery, dill, chamomile, sage, peppermint, rosemary, onions, and potatoes. They do not do well planted with strawberries, tomatoes, or pole beans.

MARKETING

RECORD KEEPING (PRODUCTION AND RESEARCH)

POTATOES
Solanum tuberosum

Cool season crop with optimum growth at a mean air temperature of 16-20C. Optimum tuberization occurs at 12C, decreasing at 20+C, and stopping by 29C. They have long day requirements and are sensitive to frost conditions. We are looking for an optimum monthly temperature of 60-65F, with a minimum of 45F and a maximum of 75F.

Need a growing season of 65 (early) to 120 (late) frost free days.
A pH range of 5.5 to 7.5, optimum 6.0-6.8, is desired. However, a combination of higher pH (above 5.2) and lack of moisture early in the crop cycle (the first 40 days after planting) can increase the risk of scab developing (Dr. Young). The moisture level should be close to field capacity. Traditional fertilizer recommendations for 18 ton/A are 235 kg/ha N, 34 kg/ha P, and 308 kg/ha K.

If planting potatoes in plots adjacent to grains, plant potatoes first to allow plenty of room for turn radius of tractor (~10' long) with planter (~10' long) on the back. Then on back and plant the adjacent grain fields.

Order 1 7/8" to 2" (No larger than 2 ½ ") seed potatoes from Southern States, call early to see when they will be taking the potato orders. These are called drop size potatoes. Calculate 2000 lbs/A (20 – 100lb bags, or 40 – 50 lb bags).

Plant the seed potatoes (4" deep max.) around the last week of April to the first week of May. Old timing is to plant when the dandelions bloom in the open. If looking for a specific plant density, seed the hills by hand. If spacing is not the consideration, use the planter. To make the yields more scientifically accurate probably should seed by hand. With seed potatoes spaced 5 – 10" apart in the row. Rows are traditionally set 30-36" apart. However, Dr. Young says if we are going to mechanically hill the rows during the growing season the rows should be 4 ½ - 5' apart. If we are going to hand hill the rows during the season, they could be closer.

VARIETY
Kenebec – main season, 90+ days, vigorous vines therefore a heavy feeder (100-150 lbs N normally required), tubers are set shallowly and must be kept well hilled to prevent greening of the tubers. They are moderately susceptible to scab. They are resistant to late blight, mild mosaic, net necrosis. They are adapted for northern growing and are one of the favorites of the home grower for our area. (fedco commercial seed $40 for 50#)

SCHEDULE
April 24 – May 5: Plant
May 8 – May 19: 2 weeks after planting when stems are 8" high,
hill up from both sides
May 22 – June 9: 2-3 weeks later hill again (can mulch instead)
June 5 – June 23: 2 weeks later hill for 3rd time

HARVEST
For new potatoes harvest 40-60 days after planting.
For main crop, leave the tubers in the ground for 2 weeks after the vines have been killed by fall frosts.

INSECT PESTS
Since the area has been maintained in sod, the tubers may be damaged by soil grubs or wireworms. The adult wireworms are hard-shelled elongated dark beetles, 1/3– ¾" long, often called click beetles. They lay the eggs on roots in early spring. The larvae hatch in 3-10 days and feed on surface roots or tubers in the spring and fall. They overwinter in the soil. Generation time can be 2-6 years.

Colorado Potato Beetle (*Leptinotarsa decemlineata*): The adults are yellowish-orange 1/3" beetles with 10 lengthwise stripes on wing covers and black spots on the thoraxes. They become active in the spring and feed on weeds and young potato plants. The females lay eggs over a 4-5 week period. The eggs are bight yellow-orange ovals standing on end in clusters. The eggs hatch in 4-9 days. The larvae are dark orange humpbacked 1/16-1/2" grubs with 6 legs, and 2 rows of black spots along each side. They feed on the foliage. The larvae stage is 2-3 weeks. They move to the soil to pupate and new adults emerge in 5-10 days. They can go from egg to adult in 21 or more days. Usually have 2 generations per year.

Potato Leaf Hopper – Dr. Young says get a handle on them quickly in the season. The adults are wedge shaped, 1/8" long and green. The are sap feeders on the underside of leaves. The fly readily when disturbed. They do not overwinter here and move into the area from the south. Eggs are laid in the stems and larger leaf veins of succulent plants. The eggs hatch in 10 days to the nymphal stage.

Aphids – Adults are pear shaped with 2 'tail pipes', long antennae, and they can be pink, green, black, gray, or white with or without wings. Colonies develop quickly and winged forms appear when they become crowded. The damage plants by direct injury of feeding, excreting honeydew which supports the growth of sooty mold, and by vectoring viral diseases. Eggs overwinter on woody stems, hatch in the spring into stem females which can give birth continuously to live nymphs without having to mate. Nymphs

mature in 1-2 weeks. Some species feed on cereal crops or weeds for part of the year and on fruit trees at other times.

Flea Beetles – Adults are black, brown, or bronze $^{1}/_{10^{th}}$ " beetles with well developed hind legs and jump like fleas when disturbed. The larvae are thin, white, legless grubs and live in the soil. Adult feeding creates shot hole effect on foliage. The adults can overwinter in the soil, emerge in spring, feed, and lay eggs on the plant roots before dying. Eggs hatch in 1 week. The larvae feed for 2-3 weeks and then pupate in the soil. The new adults emerge in 2-3 weeks. One to four generations are possible in a season.

IPM PLAN
Soil grubs and wireworms: Cultivate the soil thoroughly every week for 4-6 weeks in the fall to expose and destroy larvae. Bury raw potato pieces 4-6" deep to attract larvae, check every 1-2 days and destroy wireworms. Parasitic nematodes are effective beneficials.

Colorado Potatoe Beetle: Field scouting (see field form Appendix 2), hand pick adults and larva into container of soapy water, check under leaves for orange egg masses – remove, or crush the masses. *Bt tenebrionis* only effective on larva less than ¼" in size (young), Bt – timing is key, it should be applied at egg hatch or when larvae first appear. Walk the field several days after Bt application and handpick missed larva. An insect growth regulator, Align, has been released for control of this insect. It is an extract of the neem seed and prevents the insect larvae from developing normally.

The presence of aphids will be recorded. If aphid colonies are present the plants will be sprayed with insecticidal soap, unless paratisation is detected. If beneficials are working, then the population of aphids will be monitored for several consecutive days to guarantee the control levels. May order and release aphid midges, lady beetles, lacewings, or parasitic wasps. If outbreak is severe and soap does not work to gain control, spray with pyrethrin, sabadilla, or rotenone (Last resort only).

Flea Beetles: Prefer full sun, so if possible interplant to provide shade. Drench roots with parasitic nematodes to control larvae. Or spray with neem, pyrethrim, sabadilla, or rotenone.

Predators – 2-5 spined soldier bugs/sq yd, parasitic nematodes to attack larvae in soil, plant pollen and nectar flowers to attract predators and parasites.

NOTE The area to the left of the road on the way to the water tanks was once in orchard planting and according to the companion planting book, Carrots love tomatoes, potatoes planted near apple trees are more susceptible to late blight (*Phyophthora infestans*).

Also from the companion planting book, potatoes will benefit from planting with beans (which deter the Col. Pot. Beetle, and are protected by potato deterring the Mex. Bean Beetle), corn, flax, cabbage (planted between the rows after the 1st hilling), marigold. Planting horseradish at the corners of the plot helps protect against the potato bug and the blister beetle. Can use eggplant as a trap crop for the Col Pot. Beetle (border planting, white more attractive than purple). Nightshade weed is good for the potato bug eats it and then dies. Hemp is believed to protect the potato from late blight.

Potatoes are detrimentally affected when planted near pumpkin, tomato, raspberry, squash, and cucumber (believed to lower the resistance to late blight). Lambs-quarters indicate bad soil for potatoes.

We can coordinate the potato planter scheduling for use with Dr. Young, who is also willing to attend any meetings that he could help us with the potato decision making or evaluation process.

MARKETING
RECORD KEEPING (PRODUCTION AND RESEARCH)

SOYBEANS
Glycine max cv. 'Tyrone'

A tender warm season crop (like snap beans). Optimum temperatures for seeding and germination 60-70F, 50F minimum and 80F maximum. They require warm moist weather during the growing season. The crop is strongly responsive to photoperiod and is a short-day plant. Divided into maturity groups. Yield can be reduced by both low night temperatures or by brief periods of high temperature. Soils types should be clays with pH of 6 – 6.5 (Langer & Hill, Ag. Plants, 1991).

Once oil is removed from the bean, the remaining cake is rich in protein and used a livestock feed. Whole seed must be heat treated to render trypsin inhibitors harmless before it is safe for consumption by non-ruminants. Oil can be used as food or industrial component for paint, oilcloth, printer's ink, linoleum, and soap (Langer & Hill, Ag. Plants, 1991). (possible use as dormant oil spray for fruit trees)

VARIETIES
'Tyrone' is a cultivar that has been developed for forage production instead of bean production at Beltsville, MD. USDA recommends triple the inoculum (*Bradyrhizobium japonicum*) for soybeans. Call Tom Wasik, 888-287-2262, Urbana labs, St. Joseph, MO or talk with Joe Morton, WVU.

175-350 seeds/oz (6-12 seeds/g)

Soybean hay is 12% moisture, with 46 lbs/ton N, 11 lbs/ton P_2O_5, and 20 lbs/ton K_2O. Soybean straw is 11% moisture, 13 lbs/ton N, 6 lbs/ton P_2O_5, and 15 lbs/ton K_2O.

65 - 75 lbs/A seeding rate
minimum US standard germination = 75% (Lorenz & Maynard, Knott's handbook for veg. Growers., 1988)

seed soybeans 7" rows ½ - 1" deep

PLANTING SCHEDULE

SEED ORDERS & SOURCES
Order from Mr. Tabor 804-281-1203 (southern states) $25/50 lb bag, he will pay shipping if we take an entire bag.

INSECT PESTS
Thrips
Bean leaf beetle - The adult beetles are ¼" with light yellow to reddish wings that have 4-6 dark spots and a V pattern at the front of the wing coverings.

They overwinter in woods and around field edges. Feeding is characterized as round holes eaten through the leaves. When defoliation is above 30% them must be treated. They can also vector viral diseases.

Grasshoppers and crickets
Cutworm
Grape colaspis
Three cornered alfalfa hopper
Root feeding beetle larvae

Corn earworm - The adults a light brownish-tan, to olive colored fast flying moth. The moth has greenish eyes and a prominent dark spot on each forewing. The moths are active in the evening and dark hours, but can be seen in the field during the day. They overwinter as pupa in the soil. The moths emerge in ~April and fly to whorl stage corn or wild host plants and lay eggs for the 1st generation. The new adults moths emerge around corn pollination time, lay eggs on corn silks, and the larvae develop in the ears. As they mature, the larvae eat through the husk, drop to the ground and pupate in the soil. The new adults emerge in mid-summer and seek soybean, cotton, sorghum, and other host plants. Where they feed on foliage, vegetative terminals, and flower clusters

Stink bug

IPM PLAN
SCOUTING: Visual inspection of foliage is used to estimate the % of defoliation. Sample in ~3 sites spaced randomly in the field. If there is a high % defoliation, examine up close the plants to determine which pest is responsible. Sweep net sampling may be done, vigorously. Each sample consists of 15 separate sweeps done continuously. Make sure to get into the foliage about 15 inches during the sweeps.

Bean leaf beetle: treat with pyrethrim or neem if foliage damage is greater than 30%.

Corn earworm:.Reduce plant stresses. Use narrow rows. Create an unattractive, healthy crops with high levels of biocontrol organisms to reduce corn earworm infestation. Lastly, use pyrethrim spray.

(source NC State Extension insect note: Soybeans IPM)

HARVEST
MARKETING
RECORD KEEPING (PRODUCTION AND RESEARCH)

WHEAT
Triticum aestivum
(Winter and Spring Red)

Wheat may be a winter annual or it may be sown in the spring. The varieties for fall planting require the colder temperatures of the winter before they will initiate flower and seed production in the spring. The spring wheats are able to flower and set seed without this cold period and therefore may by planted in the spring.

It will be necessary for the growing season 2000 to sow spring wheat. For repeatability and scientific accuracy, we should plant spring wheat throughtout the experimental period and switch to fall planting of winter wheat after the first complete set of data has been collected.

Wheat is largely self pollinating and will set seed with only one variety planted. The plants go through four stages of development. They are: tillering, stem extension, heading, and ripening of the grain. Wheat yields are determined by the number of ears (spikes) per unit area of land, the number of spikelets per ear, the grain set as given by the number of florets bearing grain in each spikelet, and the weight of the individual grain.

PLANTING SCHEDULE
SEED ORDERS & SOURCES
INSECT PESTS
Aphids
Armyworms – Adults are pale, gray-brown moths with a white dot in center of forewing and have a 1 ½" – 2" wing span. They are active only at night. Moths prefer to lay eggs on various grasses and small grains. Young larvae are pale green or brown and have a habit of looping as they crawl. Older larvae are greenish brown with pale white or orange stripes running down their body. The head is honeycombed with faint dark lines. Eggs are in masses on lower leaves. The caterpillars are active at night, hiding at the base of the wheat plants during the daylight hours. They feed on foliage from the bottom of the plant up.

Cereal leaf beetle - The adult cereal leaf beetle is about $^{3}/_{16}$ inch long and has metallic, bluish black head and wing covers The legs and front segment of the thorax are rustred. Eggs are elliptical, about $^{1}/_{32}$ of an inch long, and colored yellow to burnt brownish yellow. Most often the eggs are laid singly or in small scattered groups on the upper leaf surface between, and aligned with, the leaf vein. Larvae are very small when newly hatched and grow to a maximum size that is slightly longer than the adult. Larvae are sluglike in shape and resemble small Colorado potato beetle grubs, except for their coloration. The head and legs are brownish black and the body is yellowish.

However, body coloration is usually obscured by a black globule of mucus and fecal matter held on the body, giving the larvae a shiny black, wet appearance. This liquid substance wipes off easily, and after you walk in an infested field, your shoes and trouser legs will be soiled. Small larvae eat a very small amount, but when full-grown, larvae have a voracious appetite The larvae eat long strips of green tissue from between leaf veins and may skeletonize entire leaves, leaving only the transparent lower leaf surface tissue.

Hessian Fly The adult is a small, longlegged, twowinged insect that resembles a small mosquito. The reddish female flies are about 1/8 inch long, whereas the slightly smaller males are brown or black. Red eggs are deposited on leaves, and the newly hatched larvae or maggots are also red for four or five days before turning white. As larvae mature, a translucent green stripe appears down the middle of the back. The maggot is about 1/4 inch long when full grown. The maggot transforms into an adult fly inside a dark brown case, or puparium, that resembles a flaxseed in size and shape. The puparis, or "flaxseeds," are located on the leaf surface.

IPM PLAN

Scouting Procedures Small grains should be scouted periodically throughout the growing season. October seeded small grains may require scouting for aphids, and possibly Hessian flies. Grains planted after mid-November seldom require scouting in the fall. As spring temperatures warm, periodic scouting should be done weekly on the entire acreage or at least on representative fields (for example, 20 percent of the acreage) to determine the need for more intense scouting.

Aphid Scouting: Scouting for aphids requires searching plants or examining heads on 10 samples taken at locations scattered across each field. Each sample should consist of 10 heads or all plants in 1 foot of row. Threshold - In fall if yellow dwarf virus symptoms are present and cold weather is not expected for one week or more, 20 aphids per foot. (This is the only instance where fall spraying is suggested.) In spring when the plants are 3 to 6 inches tall, 100 aphids per foot; In spring when the plants are 4 to 8 inches tall, 200 aphids per foot; In spring when the plants are 9 to 16 inches tall, 300 aphids per foot. In spring after heading out, 25 per head with 90 percent of heads infested, or 50 per head if only 50 percent of the heads are infested.

Armyworm Scouting: Fields should be scouted for armyworms weekly in May. Early May caterpillars are usually small. Once caterpillars reach 3/8 inch or more in length, take at least five samples per field (10 samples in larger fields of 20 acres and more) by examining 3 square feet of area (one 3 foot long strip containing two drill rows). Look for and count the caterpillars in litter around the base of plants and under old crop residue. Pay special

attention to fields in which birds are active. Threshold - Two 3/8-inch or longer caterpillars per square foot (6 per 3-squarefoot sample). Can control with Bt – k, and/or spray superior oil in July to kill eggs of second generation.

Cereal Leaf Beetle Scouting: Scouting should be done after peak egg laying has occurred and the majority of eggs have hatched, usually in late-April. Threshold determination should be done when most of the eggs have hatched and larvae are still small. Once egg laying has reached a peak, many fields will need only a single scouting for eggs and larvae. If the proportion of eggs in the sample is 50 percent or greater then sample again in 5 to 7 days.

Samples should be taken at a minimum of 10 random sites in the interior of each field (avoid the edges). At each site, 10 tillers (stems) should be examined for cereal leaf beetle eggs and larvae. This will result in 100 tillers (stems) per field being examined. Eggs may be on the leaves near the ground. Threshold - Twenty-five eggs and/or larva total per 100 tillers (this is an average of one per each four tillers or 0.25 eggs and/or larva per tiller).

HARVEST
MARKETING
RECORD KEEPING (PRODUCTION AND RESEARCH)

RYE/HAIRY VETCH
ORCHARD GRASS/RED CLOVER
KENTUCKY BLUEGRASS/WHITE CLOVER
- Planting schedule
- Seed orders & sources
- IPM plan
- Harvest
- Marketing
- Record keeping (production and research)

MARKET GARDEN
TOMATO
***Lycopersicon esculentum* 'Celebrity'**

Germination requirements
70-75F (21-24C) 7-14 days germination
65-75F day, 60-65F night, 5-7 weeks to transplant

'Celebrity' – F1 hybrid, 7 oz fruits, determinate bush plant, 72 days to maturity, resistant to *Verticillium*, *Fusarium* 1&2, Nematodes, and Tobacco mosaic virus; manage water to minimize cracking

Transplant 18-24" apart. Water in with a high phosphate fertilizer solution. For earliest crops, set plants out around the last frost date under floating row covers which will protect from frost to about 28F. Avoid setting out unprotected plants until night temperatures are over 45F (7C). Abundant soil phosphorus is important for early high yields. Too much nitrogen causes rampant growth and soft fruits susceptible to rot.

The number of flowers and fruits on the first 3 to 3 clusters can be increased by exposing the seedlings to a controlled cold treatment. Then the first true leaf appears, grow the plants at minimum night temperature of 50-55F (10-13C) for 3 weeks. Provide full sunlight. After 3 weeks, adjust the night temperature to 60-65F (16-18C). Sow the seed 10-14 days earlier than normal if cold treatment is to be given. (Johnny's selected seed catalog).

Storage of firm ripe fruit – 45-60F (7-16C) for 4-7 days

INSECTS

Cutworms
- sanitation of garden
- plowing before planting, good seed bed
- cardboard collars or toothpicks
- Bt

Flea Beetle
- frequent cultivation
- sanitation around garden
- keep weeds clear
- plant thickly and then thin - early feeders, shade shy
- wood ashes repel flea beetles, sprinkle on 2-3 times/week
- garlic spray
- diatomaceous earth sprinkled on the plants

White Fly
- Encarsia formosa, lacewings, lady beetles

Tomato Fruitworm
- handpicking
- garlic and onion sprays

- rotenone as a last resort
- Tachnid fly
- fluorescent light trap

Hornworms
- handpicking
- sprinkle hot pepper dust on plants
- trap crop of dill
- blacklight trap
- Bt
- Trichogramma wasp

DISEASES

Anthracnose
- disease free seed
- do not work in wet field
- resistant varieties
- remove all crop debris after harvest

Bacterial Canker
- destroy all vines after season harvest
- disinfect tools

Bacterial Spot
- avoid excess nitrogen
- use lots of phosphorous and lime
- keep soil moisture even

Bacterial Wilt
- certified seed
- remove all crop debris after harvest

Blossom Drop
- shake plants during warm sunny day

Blossom End Rot
-mulch around plants to keep even moisture
- avoid excess nitrogen
- use lots of phosphorous and lime
- keep soil moisture even

Cracking
- maintain even moisture with adequate mulch

Damping Off
- well drained seed bed

Early Blight
- resistant varieties
- plow under all detritus
- eliminate solanaceous weeds

Fusarium Wilt
- sanitation of plant debris throughout Winter
- mycorrhizal encouragement

- resistant varieties

Late Blight

- grow tomato far from solanaceous crops
- eliminate solanaceous weeds
- resistant varieties

PEPPER
Capsicun annuum 'King Arthur'

Germination
7-12 days, 72F (22C)
65-75F day, 60-65F night, 6-8 weeks to transplant

'King Arthur' – F1 hybrid, 59 days to green, 79 days to red, large bell pepper, resistant to viruses and bacterial spot races 1& 2, but not 3.

The number of flowers and fruits on the first 3 to 3 clusters can be increased by exposing the seedlings to a controlled cold treatment. Then the first true leaf appears, grow the plants at minimum night temperature of 53-55F (12-13C) for 4 weeks. Provide full sunlight. After 4 weeks, adjust the night temperature to 70F (21C). Sow the seed 1-2 weeks earlier than normal if cold treatment is to be given. (Johnny's selected seed catalog).

Set transplants 12-18" apart in rows with 24-36" between rows.
Pick peppers promptly at the correct size to encourage more fruit set. Wash and hold at 45F (7C) with 95% humidity.

INSECTS

Aphids

- encourage lady beetle population
- clear garden of aphid host plants
- companion plantings of garlic, nasturtiums,chives, coriander, anise, petunia
    - crushing companion leaves enhances effect
- soapy sprays are effective, but follow with water
- spray with strong lime water
- bright yellow dishpans filled with soapy water for the winged migrant stage
- spray with crushed turnips and corn oil

European Corn Borer

- clear garden of all debris from past crops
- handpicking
- light trap moths
- parasitic Tachnid fly, lady beetles, Trichogramma wasp
- Bt

Potato Flea Beetle

- frequent cultivation

- sanitation around garden
- keep weeds clear
- plant thickly and then thin - early feeders, shade shy
- wood ashes repel flea beetles, sprinkle on 2-3 times/week
- garlic spray
- diatomaceous earth sprinkled on the plants

Plant Bugs

DISEASES

Anthracnose

- disease free seed
- do not work in wet field
- resistant varieties
- remove all crop debris after harvest

Blossom End Rot

- avoid excess nitrogen
- use lots of phosphorous and lime
- keep soil moisture even

Bacterial Spot

- rotations
- resistant varieties

Mosaics

- try to control Aphids
- Sunflowers as a barricade
- resistant varieties

PUMPKINS
Curcurbita pepo 'Rocket'

For transplants
Sow in 1 ½" – 2" plugs, harden plants 4-7 days, transplant after frost free day with floating row covers, set 18" apart for bush and 24-36" apart for others, take care and do not disturb the roots!

For direct sow
Sow after frost free day when soil is warm (minimum 70F (21C)), Sow 2-3 seeds every 18" for bush 24-36" for others, ½ - 1" deep, thin to 1 plant per spot, rows 6-12' apart.

Seed pumpkins to mature in September for shipping and in early October for retail. Too many days of sun on fruits in the field after maturity will bleach handles and sunscald thr fruits.

Harvest before frosts or after 1-2 light frosts. Clip stem close to the vine. Store under cover in boxes or bins

2300-4000 seeds/lb, 3.5 lbs/A at 2 seeds/18" in rows and 6' between rows

'Rocket' – F1 hybrid, 95 days, medium sized at 12-20 lbs each, upright shaped with shoulder ribs, resists rot, vigorous seedlings, long vines, avg 2400 seed/lb (Untreated seed)

SQUASH
***Curcubita pepo* 'Condor'**

From transplants
Sow in 1 ½" – 2" plugs, harden plants 4-7 days, transplant after frost free day with floating row covers, set 18" apart for bush and 24-36" apart for others, take care and do not disturb the roots!

Direct seeding
Sow after frost free day when soil is warm (minimum 70F (21C)), Sow 2-3 seeds every 19-12" , ½ - 1" deep, thin to 1 plant per foot, rows 5-6' apart.

Sow every 2-3 weeks for consistent supply. Cut or twist off young fruit at a size fitting the market requirements. Harvest regularly, 2-3 times a week depending on age of plants and growing weather. Store at 32-50F with high humidity for 1-2 weeks.

'Condor' – F1 hybrid, 48 days, vigorous, open, nearly spineless bush, (untreated seed)

INSECTS
Aphids
- encourage lady beetle population
- clear garden of aphid host plants
- companion plantings of garlic, nasturtiums,chives, coriander, anise, petunia
- crushing companion leaves enhances effect
- soapy sprays are effective, but follow with water
- spray with strong lime water
- bright yellow dishpans filled with soapy water for the winged migrant stage
- spray with crushed turnips and corn oil

Garden Springtail
- keep weeds down around garden
- garlic spray on lower leaves may keep them away

Squash Bugs
- buckwheat hull mulch
- growing radishes, nasturtiums, or marigolds nearby
- sanitation is important
- pick eggs off infested plants

- resistant varieties

Squash Vine Borer
- delayed plantings or early plantings
- dispose of vines after harvest
- slit infected stems and kill borer

Spotted and Striped Cucumber Beetle
- heavy mulching
- late plantings ~ June 15th
- Neem
- powder with Rotenone if severe
- soldier beetles, Tachnid Fly, Braconid wasp

DISEASES

Bacterial Wilt
- control of cucumber beetles

Mosaic Virus
- control aphids and cucumber beetles
- eradicate milkweed, wild cucumber, and catnip

SPINACH
Spinacia oleracea 'Denali'

Germination best at cool temperatures 60-65F opt, 40F min, 75F max
Begin sowing in early spring as soon as the ground is ready.

Sow late August into September for the fall crop. Use floating row covers to protect from freezing.

For bunching and full size

Sow 9-10 seeds/ft, ½ " deep, with rows 12-18" apart. Harvest spinach full-size but before bolting, cut just below the root attachment for "rooted spinach" or cut higher for "clipped spinach".

For salad mix

Sow in a 2-4" wide band, ¾" apart, about 40 seeds/ft. Clip small leaves in 3-5 weeks, depending on time of year and speed of growth. Triple rinse leaves, sort out cut and broken leaves and package. For a continuous supple sow every 7 days.

Store at 32F (0C) and 95% humidity for 10-14 days

'Denali' – F1 hybrid, 36 days, resistant to Downy mildew races 1-4 and white rust, moderately slow bolting, upright growth.

INSECTS

Aphids

- encourage lady beetle population
- clear garden of aphid host plants
- companion plantings of garlic, nasturtiums,chives, coriander, anise, petunia
- crushing companion leaves enhances effect
- soapy sprays are effective, but follow with water
- spray with strong lime water
- bright yellow dishpans filled with soapy water for the winged migrant stage
- spray with crushed turnips and corn oil

Spinach Flea Beetle
- control weeds in and around the garden
- garlic sprays first
- rotenone as last resort

Spinach Leaf Miner
- destroy affected leaves, burn and compost them
- keep down weeds in the area
- remove any lambs-quarters

DISEASES

Blight
- control aphids

Damping Off
- plant more than enough seeds and then thin

Downy Mildew
- rotations

Fusarium Wilt
- resistant varieties
- rotations

LETTUCE
Lactuca sativa 'Crispino' & 'Winter Density'

Cool season, hardy crop that can be planted as early as the soil can be worked. Optimum growth is at 60-65F (16-18C). For best germination results sow at soil temperatures of 68F (20C) or lower. Lettuce seed exhibits thermal dormancy at 75-85F (24-29C).

For transplants

Sow seed in ¾ - 1" plug flats, covering seed only lightly with fine vermiculite, 3-4 weeks before transplanting to garden. Keep cool until germination has occurred. Harden the seedling off for 2-3 days before transplant. Properly hardened seedlings can handle temperatures of 20F (-6C). Space iceberg lettuce 12" apart in rows 18" apart. Other types can be spaced 8-12" by 12-18".

Direct seeding
Seeds germinate at temperatures as low as 40F (4C) soil temperature, but not above 75F (24C). For full-sized heads, sow in early spring as soon as soil is ready with 3 seeds every 8" in the row with rows 12-18" apart. Cover the seed lightly and keep the area evenly moist. Thin seedling to 1 plant/spot.

'Crispino' – 57 days, Iceberg type, tested free of lettuce mosaic virus in 30,000 seed sample, grower friendly.

'Winter Density' – bibb-romaine type, 28 days baby size, 54 days full size, grown spring, summer and fall, frost tolerant, (craquerelle du midi or craquante D'Avignon in France)

INSECTS

Aphids
- encourage lady beetle population
- clear garden of aphid host plants
- companion plantings of garlic, nasturtiums,chives, coriander, anise, petunia
- crushing companion leaves enhances effect
- soapy sprays are effective, but follow with water
- spray with strong lime water
- bright yellow dishpans filled with soapy water for the winged migrant stage
- spray with crushed turnips and corn oil

Cutworms
- loose collars
- land should be kept free of weeds and grass, especially during Autumn to discourage egg-laying
- plow during Autumn
- place a stiff 3" cardboard collar around plants with 1" in the soil
- variegated cutworm is susceptible to Bt
- put toothpick in with each transplant
- sunflowers are great trap crops
- till as soon as harvest is over and again in Spring

Leaf Hoppers
- keep weeds down
- do not plant near carrots or asters
- canopies of cheese cloth, muslin, or plastic mulching
- 15-watt blacklight fluorescent trap (Purdue University study)

Tarnished Plant Bug
- sprays are of limited use unless used early in the morning
- sanitation
- sabadilla dust

DISEASES

Bacterial Soft Rot
- well drained soil, hilled up rows

Big Vein
- rotation

Bottom Rot
- rotation
- upright varieties

Downy Mildew
- eliminate wild lettuces around garden

Drop
- hill up rows

Fusarium Yellows
- keep leafhopper populations down

Mosaic
- keep garden weed free
- control aphids

Seed Rot
- hill up rows

Tipburn
- no excessive fertilization

PEAS
***Pisom sativum* 'Oregon Giant'**

Cool season crop with optimum soil temperature for germination of 75F, minimum 40F, maximum 85F, and range of 40-75F. Soil pH must be 6.0 or more, with good P and K. Make the first plantings in the spring as soon as the soil can be worked. For fall planting sow seed approximately 2 months before first frost.

Sow seed 1 – 1 ½ ' apart in a 3" band, with rows 12-18" apart for bush types and 4-5' for trellising. Sow ½ - 1" deep.

'Oregon Giant' – 60 days, snow pea type, high yields of large (4 ½ x 1" pods), white flowered vines can be grown with or without trellis support, resistant to powdery mildew, enation mosaic and common wilt.

INSECTS

Aphids

- encourage lady beetle population
- clear garden of aphid host plants
- companion plantings of garlic, nasturtiums,chives, coriander, anise, petunia
- crushing companion leaves enhances effect
- soapy sprays are effective, but follow with water
- spray with strong lime water
- bright yellow dishpans filled with soapy water for the winged migrant stage
- spray with crushed turnips and corn oil

DISEASES

Fusarium Wilt

- sanitation of plant debris throughout Winter
- mycorrhizal encouragement
- resistant varieties

Powdery Mildew

- 1% baking soda and 1% horticultural oil mixed and sprayed – preventative, not curative

Ascochyta Blight

- good seed
- till under all stubble after harvest

Bacterial Blight

- prevent injury to plants
- certified seed

Root Rot

- do not overwater
- improve drainage

BEANS
***Phaseolus vulgaris* 'Provider' & ' Jade'**

Planting schedule
Seed orders & sources
IPM plan
Harvest
Marketing
Record keeping (production and research)

INSECTS

Mexican Bean Beetle (*Epilachna varivestus*)
- eliminate garden debris that serve as overwintering sites
- companion plant with garlic, nasturtiums
- spray of turnips and corn oil
- rotenone for serious infestations
- lady beetles eat the eggs
- Pediobius foveolatus parasite

Cutworms
- land should be kept free of weeds and grass, especially during Autumn to discourage egg-laying
- plow during Autumn
- place a stiff 3" cardboard collar around plants with 1" in the soil
- variegated cutworm is susceptible to Bt
- put toothpick in with each transplant
- sunflowers are great trap crops
- till as soon as harvest is over and again in Spring

Bean Leaf Beetle
- same as Mexican Bean Beetle

Potato Leaf Hopper (Empoasca fabae)
- row covers for first month of growth
- 15-watt blacklight traps (fluorescent)

Seed Corn Maggot (Delia platura)
- seeds should be soaked overnight to give a head start
- seed should be planted shallow to give plants a head start

Spider Mites
- spraying with summer oil or insecticidal soap
- spraying with water
- lady beetles
- predatory mites

Japanese Beetle
- handpicking

- remove any premature fruit or rotting fruit on the ground

DISEASES

Anthracnose

- disease free seed
- do not work in wet field
- resistant varieties
- remove all crop debris after harvest

Bacterial Blight

- see **Peas**

Bacterial Wilt

- certified seed
- remove all crop debris after harvest

Bean Rust

- plow under all crop debris after harvest

Common Mosaic

- certified seed
- control aphids
- resistant varieties

Downy Mildew

- certified seed

In GENERAL

Garden Fleahopper

- sabadilla dust

ORCHARD
The entire orchard has received minor attention in the past several years. A full commercial spray schedule was last followed in 1997. Since that time minimal spraying has occurred and the most maintanence has been by mowing the ground cover in the alleyways and between trees. The ground surface in the entire orchard is sod. The sod has been allowed to establish upto the trunks of the trees. There are no areas of clean cultivation in the orchards.

In 1999, insect monitoring was established. The traps, winged pheremone traps, were placed in the orchard in April and check periodically until September. Insects identified in the traps included red-banded leaf roller, speckled green fruitworm, spotted tentiform leafminer, codling moth, san jose scale, and tarnish plant bug. Plum curculio is a concern and damage was identified on some of the fruit. Other insects may be present but were not identified in traps designed for flying insects attracted by pheremones.

The IPM research described earlier (page 8) will provide us with a more detailed insect population identification and quantification. Weather data will be recorded for bloom, insect and disease monitoring in the orchard. This will include chilling hours accumulated, growing degree days, frosts, and other information as recorded at the weather station in the main building on the farm.

APPLE
To establish the new field crop/grazing blocks several existing free standing apple trees were removed. The remaining trees are Stayman, Prima, Redfree, Red Yorking, Northern Spy, Spur Red Delicious, Golden Delicious, Empire, Priscilla, Liberty, Cortland, Marshall McIntosh, and Granny Smith.

PEAR
The pears were also reduced in number to make room for the field crop/grazing plot establishment. The remaining trees are Seckel, Magness, Red Bartlett, Anjou, and Bartlett.

Apple tree specifics by cultivar

Cultivar	Flowering	Chilling hours	Days bloom - harvest	Harvest
Cortland	Early-mid 3		125-140	m-l Sept.
Empire	Early-mid 4		140-160	m-l Sept.
Golden Delicious	mid-late 8		140-160	E Oct.
Granny Smith	mid 7		180-210	E Nov.
Liberty	Early 2			m-l Sept.
Marshall McIntosh	Early 1		125-145	M Sept.
Northern Spy	Late 9		145-170	M Oct.
Prima				
Priscilla				
Red Delicious	mid 6		140-160	L Sept.-E Oct.
Red Yorking				
Redfree				
Stayman	Early-mid 5		160-175	L Oct.

Pear tree specifics by cultivar.

Cultivar	Order of bloom	Chilling hours	Days bloom - harvest	Harvest
Anjou	4		140-165	L Sept.
Bartlett	1		115-135	L Aug.-e Sept.
Magness				
Red Bartlett	2		115-135	l. Aug.-e Sept.
Seckel	3		120-140	E Sept.

ORCHARD

APPLE INSECTS

Scientific name	**Common name**	**Time of traditional control application**	**Predators**	**Botanicals**
	Leaf hoppers	When appear		
Aculus schlechtendali	Apple rust mite	When mites appear		
Archips argyrospilus	Fruittree leaf roller	Bud burst or petal fall		
Argyrotaenia velutinana	Red banded leaf roller	Petal fall and 1st cover and 5th and 6th cover		
Bryobia rubrioculus	Brown mite	Delayed dormant		
Chionaspis furfura	Scurfy scale	Delayed dormant or when eggs hatch petal fall to 1st cover		
Conotrachelus nenuphar	Plum curculio	Post bloom, petal fall		
Cydia pomonella	Codling moth	3 weeks after petal fall and at 3 wk intervals		
Datana ministra	Yellow-necked caterpillars	When young appear (July to Aug.)		
Diaspidiotus ancylys	Putnam scale	Crawlers, 2nd 6th 7th covers, or dormant		
Eriosome lanigerum	Woolly apple aphid	Prepink/pink or when aphids appear(asap)		
Hyphantria cunea	Fall webworm			
Lepidosaphes ulmi	Oystershell scale	Delayed dormant or when eggs hatch petal fall to 1st cover		

Scientific name	**Common name**	**Time of traditional control application**	**Predators**	**Botanicals**
Lithocolletis spp.	Unspotted and spotted tentiform leaf miners			
Lygidea mendax	Apple red bug	Petal fall		
Magicicada spp.	Periodical cicadas	Late may or early June as adults emerge (early in morning)		
Malacosoma americanum	Eastern tent caterpillars	When caterpillars appear		
Malacosoma claifornicum pluviale	Western tent caterpillars	When caterpillars appear		
Panonychus ulmi	European red mite	Delayed dormant		
Phytoptus pyri	Pear leaf blister mites	Late dormant, bud swelling, after harvest of during migration in the fall		
Polillia japonica	Japanese beetle	When appear		
Quadraphidiotus forbesi	Forbes scale	Crawlers, 2nd 6th 7th covers, or dormant		
Quadraspidiotus perniciosus	San Jose scale	Crawlers, 2nd 6th 7th covers, or dormant		
Rhagoletis pomonella	Apple maggot	When flies are active and laying		
Schizura concinna	Red-humped caterpillar	When young appear (July to Aug.)		

Scientific name	Common name	Time of traditional control application	Predators	Botanicals
Scolytus rugulosus	Shothole borer	When adults are active in May & Sept. or after crop is harvested		
Spilonota ocellana	Eye-spotted bud moth	Delayed dormant to first cover		
Tetranychus urticae	Two-spotted spider mite	When infestation threatens		
Thyridopteryx ephemeraeformis	Bagworm	May or June when young bagworms appear		

APPLE DISEASES

SCIENTIFIC NAME	COMMON NAME	TRADITIONAL TREATMENT	IPM	ORGANIC TREATMENT
Venturia inaequalis (ascomycete)	Apple scab	Cover and protect the developing buds and repeat 3-8 day interval	Fungus overwinters mainly as mycelium in fallen leaves. Alt. Wet/dry 20C opt. for ascospore maturation in spring. Young leaves/fruit susceptible to 1^{o} infec.	
Podoshaera leucotricha (ascomycete)	Powdery Mildew of Apple	tight cluster or pink stage and continue at 5-7 day interval Cold winter & dormant pruning	Overwinters in infected buds. Will infect other buds in spring.	Cold winter & dormant pruning
Erwinia amylovora (bacterium)	Fire Blight	Streptomycin or copper dust spray during bloom and early post-bloom. Summer prune blighted limbs (disinfected tools).	Overwinters in blighted twigs and stem cankers. Infection (exudates from lesions) spread by wind/insect to flower tissues, epidermis of young shoots and wounds	Resistant cultivars. Summer prune blighted limbs (disinfected tools).
Pseudomonas syringae (bacteria)	Bacterial Canker	Fall and winter copper fungicides. Resistant root stocks.	Spread by rain and infects through wounds or tender tissues in early spring. Especially in cold/wet weather or frost conditions at bloom.	Resistant root stocks

SCIENTIFIC NAME	**COMMON NAME**	**TRADITIONAL TREATMENT**	**IPM**	**ORGANIC TREATMENT**
Agrobacterium tumefaciens (bacterium)	Crown Gall	Gall free nursery stock and resistant root stocks	Opt. temps. lower than for tree growth. Infection in early spring and late fall through lesions on truck or roots.	Gall free nursery stock and resistant root stocks
Phytophthora spp. (phycomycetes)	Root rot and Collar rot	Keep the surface soil around the truck dry and use resistant rootstocks		Eliminate undue soil wetness. Resistant rootstocks.

Management plan
IPM plan
Harvest
Marketing
Record keeping (production and research)

PEAR

- Management plan
- IPM plan
- Harvest
- Marketing
- Record keeping (production and research)

WOODLOT

- IPM plan
- Harvest
- Marketing
- Record keeping (production and research)

LIVESTOCK PRODUCTION

COMPOST PRODUCTION

FRUIT PRODUCTION

SOIL FERTILITY MANAGEMENT

APPENDIX I – SEED REQUIREMENTS
PASTURE/FIELD CROPS

SEEDING RATES
Orchard grass (*Dactylis glomerata*) 12 lbs/A
Potomac or Kenstar from Southern States
Red clover 'Kenstar' (*Trifolium pratense*) 6 lbs/A

Kentucky Bluegrass (*Poa pratensis*) 8 lbs/A

White clover (*Trifolium repens*) 2 lbs/A

Soybeans (*Glycine max* cv. 'Tyrone') 65 lbs/A
Tyrone (forage soybean developed in Beltsville, MD)
USDA recommends triple innoculum
Tom Wasik 888-287-2262, Urbana labs, St. Joseph MO

4 treatments replicated in 3 randomized blocks
Trt 1 = low input with animals (7 plots)
Trt 2 = low input without animals (4 plots)
Trt 3 = high input with animals (7 plots)
Trt 4 = high input without animals (no area in pasture grass/clover) (4 plots)
Additional land (hill land) will be assigned to each animal treatment. It will be permanent grassland and will be 87.13% of the total area in the system.

Treatment Blocks
Block 1 = 22 plots @ 18' * 100' = 1800 sq ft each
Block 1 = 39600 sq ft total (22 plots)
Block 2A = 9 plots @ 17' * 74' = 1258 sq ft each (11322 sq ft total)
6 plots @ 22' * 57' = 1254 sq ft each (7524 sq ft total)
Block 2B = 7 plots @ 17' * 74' = 1258 sq ft each (8806 sq ft total)
Block 2 = 27652 sq ft total (22 plots)
Block 3A = 14 plots @ 18' * 100' = 1800 sq ft each (25200 sq ft total)
Block 3B = 8 plots @ 18' * 100' = 1800 sq ft each (14400 sq ft total)
Block 3 = 39600 sq ft total (22 plots)
Year 2000
In each block, 8 plots for trt 1 & 2 will be planted in cover crops only.

In each block, plots will be planted to orchard grass/ red clover and grazed for trts 1& 3.

In each block, 2 plots will be planted to each of the 4 rotation field crops for trt 3 & 4.

SEED AMOUNTS
BLOCKS 1 & 3

Orchard grass (Dr. Bryan)

Block 1 – 6 plots * 1800 sqft = 10800
Block 2 – 6 plots * 1256 sqft = 7536
Block 3 – 6 plots * 1800 sqft = 10800
Total = 29136 sq ft / 43560
= 0.67 acres
12 lbs/A * 0.67 acres = 8.04 lbs

Red Clover for same blocks (Dr. Bryan)

6 lbs/A * 0.67 acres = 4.02lbs

Red Clover to over-seed existing pasture areas

6 lbs/A * 3.36 acres = 20.14 lbs

BLOCK 2

Kentucky Bluegrass/white clover

Entire area will be planted to Bluegrass/white clover
Plot area 27652 sqft (0.64 acre)
Remaining area 150,718 sqft (3.46 acres)
Total =~4.1 acres (entire area of block 5 orchard)

Kentucky Bluegrass 8 lbs/A * 4.1 acres = 32.8 lbs
White clover 2 lbs/A * 4.1 acres = 8.2 lbs

ALLEYWAYS

Block 1	23 * 3' * 100'	=	6900 sqft
	22 * 21' * 3'	=	1386 sqft
Block 2	16 * 3' * 74'	=	3552 sqft
	6 * 3' * 57'	=	1026 sqft
	22 * 3' * 21'	=	1386 sqft
Block 3	26 * 3' * 100	=	7800 sqft
	22 * 3' * 22'	=	1386 sqft
	Total	= 23436 / 43560 = 0.54 acre	

Kentucky Bluegrass 8 lbs/A * 0.54 acre = 4.32 lbs
White clover 2 lbs/A *0.54 acre = 1.08 lbs

Market Garden alleyways

0.4 acre * 8 lbs/A = 3.2 lbs Kentucky Bluegrass
0.4 acre * 2 lbs/A = 0.8 lbs white clover

FIELD CROPS

Soybeans (Dr. Bryan)

Block 1 – 2 plots * 1800 sqft = 3600 sqft
Block 2 – 2 plots * 1256 sqft = 2512 sqft
Block 3 – 2 plots * 1800 sqft = 3600 sqft
Total = 9712 sqft / 43560 = 0.23 acre
65 lbs/A * 0.23 acre = 14.95 lbs

Brussels sprouts (Knott's Handbook)

Block 1 – 2 plots * 1800 sqft = 3600 sqft
Block 2 – 2 plots * 1256 sqft = 2512 sqft
Block 3 – 2 plots * 1800 sqft = 3600 sqft
Total = 9712 sqft / 43560 = 0.23 acre
1.5 lbs/A * 0.23 acre = 0.35 lbs * 16 = 5.6 oz

Wheat (Knott's Handbook)

Block 1 – 2 plots * 1800 sqft = 3600 sqft
Block 2 – 2 plots * 1256 sqft = 2512 sqft
Block 3 – 2 plots * 1800 sqft = 3600 sqft
Total = 9712 sqft / 43560 = 0.23 acre
75 lbs/A * 0.23 acre = 17.25 lbs

Potatoes (Dr. Young)

Block 1 – 2 plots * 1800 sqft = 3600 sqft
Block 2 – 2 plots * 1256 sqft = 2512 sqft
Block 3 – 2 plots * 1800 sqft = 3600 sqft
Total = 9712 sqft / 43560 = 0.23 acre
2000 lbs/A * 0.23 acre = 460 lbs

APPENDIX 1
SEED PRICES – FIELD CROPS

CROP	SEEDING RATE	SEED NEEDED	SOURCE	ORGANIC vs UNTREATED	PRICE per UNIT	TOTAL PRICE
SOYBEANS 'Tyrone' (forage)	65 lbs/A	15-20 lbs	Southern States Mr. Tabor 1-804-281-1203	Untreated	$25/50 lbs	$25 he will pay SH
RED SPRING WHEAT	75 LBS/A	18 lbs	Southern States Bute 86		$12.75/bu	$ 12.75
POTATOES 'Kennebec'	2000 lbs/A	460 lbs	Southern States Drop size (b)	Untreated	$12.50/50lb	$125.00
ORCHARD GRASS	12 lbs/A	25 lbs	Southern States 'Benchmark'		$1.54/lb	$ 38.50
RED CLOVER	6lbs/A	10 lbs	Southern States		$2.17/lb	$ 21.70
KENTUCKY BLUEGRASS	8 lbs/A	10 lbs (field&market)	Southern States		$1.84/lb	$ 18.40
WHITE CLOVER	2 lbs/A	12 lbs to over seed 6A of pasture	Southern States		$3.43/lb	$ 41.16
WINTER RYE	60-120 lbs/A		Southern States		$8.25/56lb	$ 24.75
PERENNIAL RYE	6-10lbs/A for mixture		Southern States		$1.64/lb	$
	25-35lbs/A alone					$
HAIRY VETCH	20lbs/A				$1.65	$ 82.50

Winter Wheat $8.25/50lb bag

CROP	SEEDING RATE	SEED NEEDED	SOURCE	ORGANIC vs UNTREATED	PRICE per UNIT	TOTAL PRICE
SOYBEANS (forage)	65 lbs/A	15-20 lbs	Albert Lea 'Derry'		$25/50 lbs	$25 + S&H
RED SPRING WHEAT	75 LBS/A	18 lbs	Irish-eyes.com	Organic	$18/10lbs	$36 + S&H
'Oxen'			Albert Lea	Registered	$7.25/lb	20 lbs $145 + S&H
POTATOES 'Kennebec'	2000 lbs/A	460 lbs	Irish-eyes.com	Organic	$48/50 lbs	$480 + S&H
			Fedco (Moosetubers)	Organic	$40/50 lbs	$400 + S&H
				Comm. Seed	$14/50 lbs	$140 + S&H
ORCHARD GRASS 'Potomac'	12 lbs/A	25 lbs	Albert Lea 'Potomac' 'Pennlate'	Untreated	$0.89/lb $1.03/lb	25 lbs $22.25 + S&H $25.75 + S&H
RED CLOVER	6lbs/A	10 lbs	Albert Lea 'Arlington'	Cert. Blue tag Untreated	$1.35/lb	$13.50 + S&H
			Seeds of Change	Organic	$16/5 lbs	$32 + S&H
KENTUCKY BLUEGRASS	8 lbs/A	10 lbs (field&market)	Albert Lea 'Ginger Grazing'	Untreated	$1.75/lb	$17.50 + S&H
WHITE CLOVER	2 lbs/A	12 lbs to over seed 6A of pasture	Albert Lea (dutch)	Untreated	$1.80/lb	$21.60 +
			Albert Lea 'Alice Grazing'	Untreated	$3.25/lb	$39.00 +
			Albert Lea white blossom sweet	Untreated	$1.99/lb	$23.88 +

CROP	SEEDING RATE	SEED NEEDED	SOURCE	ORGANIC vs UNTREATED	PRICE per UNIT	TOTAL PRICE
WINTER RYE	60-120 lbs/A		Albert Lea 'Rymin'	Uncertified	$4.95/Bu	
PERENIAL RYE	6-10lbs/A for mixture		Albert Lea 'Linn'	Certified	$1.00/lb	
	25-35lbs/A alone		Albert Lea 'Polly'	Untreated	$1.05/lb	
			Albert Lea 'BG34' (Barenburg)		$1.68/lb	
			Albert Lea 'Bison'		$1.30/lb	
HAIRY VETCH	20lbs/A		Albert Lea	Untreated	$1.15/lb	
			Seeds of change	Organic	$14/5 lbs	

Albert Lea shipping=

Handling = $2 first bag + $1 each additional bag = 8 bags for $9.00 total

To break a 50 lb bag or bushel = 10-20 lbs add $0.20/lb, 21-49 lbs add $0.10/lb

APPENDIX 2
Sample record sheets for farm IPM

FIELD CROPS
BRUSSEL'S SPROUTS

Date	Clean OR infested	Diamondback moth	Cabbage looper	Imported cabbage worm	Aphids (yes or no)	comments

POTATOES

Date	Wireworms Raw potato trap #	Col Potato ~~Beetle~~ Adult 3/% defol	Larvae	Egg masses	Aphids Yes/no	comments

SOYBEAN

Date	% defoliation	Bean leaf beetle	Corn earworm	Other insects	Comments

WHEAT

Date	Armyworm #/3sqft	Cereal leaf Beetle	Aphids #/1ft row	Other insects	comments

PASTURE GRASSES

Date					

MARKET GARDEN

ORCHARD, APPLE

ORCHARD, PEAR

APPENDIX 3 WVU Organic research farm
Land ownership and
Adjacent land owners as of March 2, 2000

District & map	Parcel	Name	Address	Deed Book
Morgantown 1- 58	1	State of WV Board of Govenors		12-15-67 668 -646
Morgantown 1- 58	2	State of WV Board of Govenors		12-15-67 668-646
Morgantown 1-58	3	State Board of Control		2-1-16 140-75
Morgantown 1-58	4	State of WV Board of Govenors		9-19-66 653-548
Morgantown 1-59	5	State Board of Control		3-10-16 140-466
Morgan 12-04F	102.1	Gregory S.& Pamela S Gutta	688 Killarney Dr. Morgantown, WV 26505	10-6-88 984-172
	103	Gregory S.& Pamela S Gutta	688 Killarney Dr. Morgantown, WV 26505	10-6-88 984-172
	104	James F. Crytser	185 School Street Morgantown, WV 26505	6-25-90 1013-248
	104.1	Gregory S.& Pamela S Gutta	688 Killarney Dr. Morgantown, WV 26505	10-6-88 984-172 (20'row)
	104.2	James F. Crytser	185 School Street Morgantown, WV 26505	6-25-90 1013-248
	104.4	Gregory S.& Pamela S Gutta	688 Killarney Dr. Morgantown, WV 26505	10-6-88 984-172 (20'row)
	108	Ralph & Mary Louise Johns	505 Lewis St. Morgantown, WV 26505	9-21-60 589-295
Morgan 12-08A	29.1	Albert H. & Louise A. Wade	550 Lewis St. Morgantown, WV 26505	6-22-78 807-449
	29.4	Ralph & Mary Louise Johns	505 Lewis St. Morgantown, WV 26505	6-13-69 687-92

District & map	Parcel	Name	Address	Deed Book
	29.6	Ralph & Mary Louise Johns	505 Lewis St. Morgantown, WV 26505	5-5-76 774-490
	30.1	Andrew Jr. & Jimmye Morris	PO Box 4038 StarCity, WV 26504	5-25-84 904-591 (ROW)
	30.2	J R Veltri Company Inc	3131 N.Greystone Dr. Morgantown, WV 26505	10-31-91 1038-251 (ROW)
	75	Mendell & Helen Baker	825 Liberty St. Morgantown, WV 26505	5-19-67 661-301
	76	Richard E. Panico Sr	441 Beechurst Ave Morgantown, WV 26505	6-21-95 1110-145
	77	Judy D & Ellsworth E. Molter	849 Liberty St. Morgantown, WV 26505	12-6-76 784-333
	82.1	Judy D & Ellsworth E. Molter	849 Liberty St. Morgantown, WV 26505	12-6-76 784-321
	81	Judy D. & Ellsworth E. Molter	849 Liberty St. Morgantown, WV 26505	12-6-76 784-333
	83	Dennis E. & Vivian V. Hovatter	PO Box 220 Morgantown, WV 26505	3-15-95 1104-30