Staff Paper

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This bulletin represents a tool that can help producers, consultants, educators, and agribusinesses working with producers estimate costs of production and expected profit based on "typical" onion management strategies found in Michigan. Because sorting and packing practices differ widely throughout the industry, this budget DOES NOT include the costs of sorting, packing and bagging. It represents the cost to produce onions up to their delivery to a packing facility. The budget included in this bulletin will allow users to revise inputs based on their management strategies and calculate their expected cost and profit. This flexibility provides a decision aid to search for systems that generate higher net returns to the farm's resource base.

The brief outline of cultural and pest management practices included in this publication should be supplemented with publications from Michigan State University or from other Universities. See the References section for resources. Many are available on-line.

Onion Production

A majority of Michigan onion production occurs in south central and southern lower Michigan in Allegan, Barry, Eaton, Ionia, Kent, Ottawa, Newaygo and Van Buren counties. Onions are normally planted between April 1 and May 10. To protect the onion seedlings from wind damage, barley is broadcast seeded either prior to or at the time of seeding the onions. In a normal year, early-maturing onions (90 to 100 days) that are seeded in April are ready for harvest by late August. Late-maturing onions (110 to 120 days) mature in mid- to late September. Spanish cultivars developed for the northwestern states usually do not mature in Michigan if grown from seed. Only long-day cultivars can be grown from seed in Michigan. Intermediate or short-day cultivars can be grown successfully from transplants. Harvesting begins in early August and continues through October. Curing is started in the field and finished while in storage. Generally, Michigan weather conditions are not favorable for field curing.

Onions should be grown on friable soils, which contain high amounts of organic matter, have good water-infiltration rates, and good moisture-holding capacity. The soil should not be compacted, and the pH should be 5.8 to 6.6. Sandy loams and muck soils are often used for onion production. Most onions produced in Michigan are grown on muck soils.

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Site Selection & Planting

Onions can be grown on mineral or muck soils. Deep muck soils are ideal for onion production because of their good water retention, high nitrogen content, ease of nutrient management and ease of harvest. When onions are grown on sandy or marly mucks or mineral soils, more careful irrigation and fertilizer management is required. Each soil should be managed accordingly. A soil test should be conducted every 2 years.

Mineral soils have better drainage and higher rate of leaching so pH should be maintained between 6.2-6.8. Broadcast and disk in all fertilizer prior to planting. On very light soils following leaching rains, additional N may be needed in a sidedress application. Too much N may delay maturity. Muck soils are higher in organic matter and hold moisture so are easier to manage.

Transplant onions are seeded in the greenhouse ten to twelve weeks prior to planting in the field. Because onions are a cool season crop, they can be transplanted as early as mid-March. When producing transplants in the greenhouse, the plant tops should be trimmed to a 4-inch height to produce a stout, sturdy transplant. Sets are small dry onion bulbs produced the previous year. They can be planted later in the year than transplants and still produce a marketable crop.

In Michigan, May 10 is normally the last day to plant full-season cultivars and to obtain normal maturity. Early-maturing cultivars can be seeded as late as May 20, but size and yields may be reduced. Maximum yields of pungent yellow onion bulbs over 2 inches in diameter are obtained with plant populations of about 200,000 plants per acre. Uniform spacing of plants in the field will improve bulb shape. Because of their limited onion root system, onions require a constant supply of water throughout the growing season. Deep muck soils with a high water table may produce a good crop of onions without irrigation, but irrigation will help to assure an adequate harvest. If rain is inadequate, supply 1 inch of water per week until July 1 and 1.5 inches per week until tops begin to fall over. Dry weather after tops fall over will help onions mature faster, resulting in higher quality.

Pest Management

When seeking advice on use of labeled pesticides (including herbicides), please refer to the most current versions of Michigan State University Extension Bulletins titled "Insect, Disease and Nematode Control for Commercial Vegetables" (Extension Bulletin E-312) and "Weed Control Guide for Vegetable Crops" (Extension Bulletin E-433). They are available on-line at http://www.msue.msu.edu/vegetable/Resources/E312/E312.htm and http://www.msue.msu.edu/vegetable/Resources/weeds/weed.htm *respectively. Specific herbicide and pesticide names have been used in this publication to facilitate accurate budgeting. Michigan State University does not endorse any of the brand name products listed and does not direct producers to limit management systems to these products.*

Pest management is critical to reduce damaged bulb and disease build-up. A field scout can notice early pest outbreaks and greatly reduce yield losses and unnecessary pesticide applications. A subscription to the MSU Vegetable Crop Advisory Alert would provide a good pest management reference. It is available as a mail subscription or over the internet at http://www.msue.msu.edu/ipm/vegCAT.htm

Weed control is crucial in onion production due to the slow growth, small stature, shallow roots, and thin canopy of onion seedlings. Weed pressure before bulb formation significantly reduces yields during bulb development and drying. Weeds should be controlled early before establishment and annual weeds should not be allowed to form a seed head. Yellow nutsedge (*Cyperus esculentus*) is an extremely serious onion weed pest on both muck and mineral soils. It is a perennial monocot with grass-like foliage, but it is not a true grass, and is not controlled with grass herbicides. Even light infestations in onion fields can reduce onion bulb size. This weed can be somewhat controlled through the integrated use of herbicides and cultural practices such as controlling weed banks, maintaining weed-free field borders and cleaning equipment. Winter cover crops can be used to suppress weed growth and add to the soil.

Insect pests include onion maggots and thrips, both of which have the potential to reduce or destroy crops in any given year. Onion maggot larvae feed on the belowground hypocotyl tissue of seedlings. Larval feeding may kill seedlings; therefore, poor plant stands may indicate an onion maggot problem. In larger plants, larvae may tunnel into the bulb causing plants to become flaccid and yellow. Later generations damage bulbs, often causing them to rot, and render them unfit for sale or consumption. Cull onions should not be disposed of on production fields since they provide an overwintering site for onion maggot pupae. Adults emerge about mid-May and mate over a three-day period then begin laying tiny white eggs at the base of the plant. There are 3 generations of onion maggot per season. The third generation attacks onions in mid-August shortly before harvest. Feeding damage at this time can contribute to storage rot since onion maggots can introduce bacteria into the feeding wounds. Crop rotation can be very effective, but must provide at least one mile of separation between new seedlings and previous crops or cull piles. Because adult flies are attracted to damaged onions, minimizing herbicide or mechanical damage can be helpful. Thrips are often found between the leaf sheath and stem on onions where they are out of reach of insecticides and many natural control agents. Thrips primarily damage crops directly by their rasping and feeding activities, causing whitish blotches on leaves. Severe damage to onions will cause leaves to senesce prematurely and bulbs to become distorted or remain undersized. Hot, dry weather is correlated with occurrence of severe thrip problems. Adults and nymphs over winter on plants or debris or along weedy field edges. There are usually 5-8 generations per year, and they have a relatively wide host range but control is most effective from mid to late summer.

Diseases. Several onion diseases can cause crop losses, especially downy mildew, purple blotch, and *Botrytis* leaf spot. Using a good crop rotation system and disease resistant onion varieties, can prevent many of these diseases. Excessive and late season applications of nitrogen fertilizer can delay onion maturity, lengthen requirements for field or storage curing, and increase storage losses from downy mildew and botrytis neck rot. The pathogens enter plants or bulbs through wounds (hail, harvest damage); senescent or dead leaf tissue or tips (due to herbicide burn, pollution damage, water stress), closely topped necks, or improperly dried necks. Plant high-quality onion seed and transplants free of contamination. Follow fertility recommendations carefully and avoid excess (greater than 200 pounds per acre) or late (after July 15) applications of nitrogen. Split nitrogen applications are recommended. Follow good weed management practices. Do not irrigate within 10 to 14 days of lifting. For current pesticide recommendations see reference.

Downy mildew of onion is caused by *Peronospora descructor* (Berk.) Casp. Ex Berk. Downy mildew symptoms appear on older leaves as elongated patches that vary in size and are slightly paler than the rest of the foliage. When moisture is present, these areas become covered with a violet-gray mycelium that contains spores that may spread to surrounding healthy tissue. The oval lesions may be violet to purple and confused with the initial elongated lesions of purple blotch. Affected leaves gradually become pale green and later yellow. Diseased parts, such as leaf tips, fold over and collapse. Systemically infected bulbs become soft, shriveled and watery. Purple blotch of onion is caused by *Alternaria porri* (Ellis) Ciferri. This fungus is also a pathogen of leek, garlic and chive. Purple blotch infection often follows injury caused by germinating *Botrytis* spores (small, whitish, sunken spots), thrips, hail, wind-blown soil or pollution. Individual leaves are more susceptible to infection as they age and young emerging leaves become more susceptible as bulbs mature. *Alternaria* spores germinate on onion leaves and produce a small, water-soaked spot that turns brown. The elliptical lesion enlarges, becomes zonate (target spot) and purplish. The margin may be reddish to purple and surrounded by a yellow zone. During moist weather, the surface of the lesion may be covered by brown to black masses of fungal spores. Botrytis Leaf Blight, *(Botrytis squamosa)* causes a common destructive disease of onion. The disease kills foliage and spreads so rapidly that growers gave it the name "blast". Onion plants are predisposed to blast by other diseases, insect damage, mechanical injury, and air pollution damage. The fungus survives in the soil and on plant refuse as small black bodies called sclerotia. During hot, humid weather, sclerotia give rise to airborne spores. These lodge on wet onion foliage, germinate, and enter the plants through wounds, especially during the early stages of bulbing. When conditions favor spread, the disease progresses rapidly and numerous lesions appear on each leaf. It can also be a problem in storage. Botrytis neck rot, caused by the fungus *Botrytis allii*, is a destructive and widespread storage disease. The initial infection originates in the field but symptoms generally do not appear until harvest and storage, after the onions have been topped. Infection typically occurs when the weather is cool and moist during harvest and onions do not dry properly. Growers can decrease their losses by harvesting in dry weather when onions are at full maturity, and storing harvested onions under optimum conditions. The condition of the neck tissue at the time of harvest is important in determining the amount of infection. The more succulent the tissue, the greater the likelihood of infection. If bulbs mature well during dry weather before harvest, the chances of infection are greatly reduced. The fungus survives in the soil and on crop residues. Once the disease begins to develop, scales begin to soften around the neck progressing toward the base. Infected tissue takes

on a brownish, sunken, water-soaked appearance. This disease can be controlled using a combination of clean fields and pesticides. For selection of appropriate pesticides, see reference.

Harvesting, Curing and Storage

Onions may be treated with maleic hydrazide (MH) in the field to reduce sprouting during and after storage. MH suppresses new growth in mature bulbs that have reached their normal resprouting time. For onions stored until mid-fall or winter, maleic hydrazide (2.7 qt of MH-30/A) should be applied when approximately 50% of the tops are down, the bulbs mature, the necks are soft and 5-7 leaves are still green (see the product label). Onions are mature when they stop producing new leaves. The neck then begins to shrink and leaves fall over. Onion bulbs continue to gain size and weight until leaves are dry. Bulbs are harvested mechanically and moved from the field in bulk bins or trucks.

Onions should be cured during the initial stages of storage through exposure to warm air (75-90°F). After curing, storage temperature can be gradually decreased. Onions should be warmed to 50°F before packing to avoid moisture condensation on bulbs.

Cost of Production Budget

The budget developed using information gathered from growers is presented in Table 1. Details of some practices are mentioned in footnotes. To adapt this budget, insert or remove individual practices as necessary.

Because expected prices and yields vary across years and producers, no revenue was included in this budget. However, Table 2 shows expected net returns at a variety of typical prices and yields. Where indicated in the budget, the cost structure does vary by yield. Use of this table should help producers compare expected returns from typical prices and yields using practices outlined above and detailed in the budget. ***If the budget is modified to better fit a different production system, Table 2 will not accurately represent net returns per acre.***

Approach

The information on onion cost structure and yields was developed using a focus group of growers with a good knowledge of the industry and good field, enterprise, and financial records. The process was initiated by defining an onion production system and strategic planning context representative of southern Michigan. Subsequently, both the sequence of decisions and the information necessary to make these key decisions were collected. This process resulted in a list of inputs and input prices that were then translated into costs, which were verified against grower records.

Because the production system and details were derived from grower input, fertilizer and chemical use may not match some horticultural recommendations. All grower practices were verified and do reflect current procedures. The following budget reproduces, as completely as possible, all costs incurred by these growers.

Pricing Annual Costs of Capital Services (Buildings, Machinery, and Equipment)

Estimating the annual cost of using buildings, machinery, equipment and other assets is a challenge in cost of production studies. In previous studies of Michigan horticultural crops,

focus groups constructed a representative farm with fixed acreage and then constructed the buildings, machinery, and equipment needed to operate this farm. They also generated associated labor needs and repair and operating costs. This approach has the advantage of being very tangible but also makes it difficult to interpret results for alternative farm sizes.

In this study, an alternative approach was taken. Buildings, machinery and services were priced to the enterprise on a "custom" basis. Further, services such as land preparation were priced to the enterprise as a "bundled" service/task reflecting both the machinery and labor components of the service.

This approach requires some judgment because costs such as buildings to house machinery and equipment, the farm shop, and labor used in maintenance of machinery and equipment must be included in the "custom fee" as well as the "depreciation and interest" on the machinery and equipment. The fact that this custom fee approach was used does not imply that custom operators did all the tasks. It simply means the tasks are priced to the enterprise as if a custom operator had completed them. The services may well have been provided by the "machinery services enterprise" of the farm. As a double check, members of the focus group attempted to compare the aggregate custom fee costs to those based on their accounting records which included labor, custom fees, and depreciation and interest on buildings, machinery, and equipment. Custom fees were also double-checked against survey information when available.

References

2002 Insect, Disease and Nematode Control Recommendations. George Bird, Beth Bishop, Ed Grafius, Mary Hausbeck, Lynnae J. Jess, William Kirk and Walter Pett. 2002. Michigan State University Extension Bulletin E-312. Michigan State University, East Lansing, Michigan. [On-line]. Available September 13, 2002: 517-353-7168 or http://www.msue.msu.edu/vegetable/Resources/E312/E312.htm

2002 Weed Control Guide for Vegetable Crops. Bernie Zandstra, et. al. 2002. Michigan State University Extension Bulletin E-433. Michigan State University, East Lansing, Michigan. [On-line]. Available September 13, 2002: 517-353-7168 or http://www.msue.msu.edu/vegetable/Resources/weeds/weed.htm

Fertilizer Recommendations for Vegetable Crops in Michigan. D.D. Warncke, , D.R. Christenson, L.W. Jacobs, M.L. Vitosh, and B.H. Zandstra. 1994. Michigan State University Extension Bulletin E-550B. Michigan State University, East Lansing, Michigan. [On-line]. Available September 13, 2002: http://www.msue.msu.edu/msue/imp/modaf/55092001.html

Commercial Vegetable Recommnedations: Onions. B.H. Zandstra, E.J. Grafius, M.L. Lacy, D.D. Warncke. 1996. Michigan State University Extension Bulletin E-1307. Michigan State University, East Lansing, Michigan. [On-line]. Available by calling: 517.353.7168 or http://www.msue.msu.edu/vegetable/bulletins.htm

Crop Profile for Onions in Wisconsin. K.A. Delahaut. 1999. University of Wisconsin, Milwaukee, Wisconsin. Available by calling 608-262-1490.

Crop Profile for Onions in New York. Lee Stivers. 1999. Cornell University Cooperative Extension. Cornell University, Rochester, New York. [On-line]. Available September 13, 2002: 716-461-1000 or http://pestdata.ncsu.edu/cropprofiles/docs/nyonions.html

Table 1. Fresh market onion budget. Michigan, 2002.

Onion, Fresh Market

DOES NOT include costs associated with sorting, packing and bagging onions.

	Quantity	Unit	Price per Unit	Cost per Acre	Your Farm
REVENUE SOURCES					
Onions[1]	600	bags		$ -	
TOTAL REVENUE				**$ -**	
EXPENSES					
Soil sampling[2]				$ 2	
Spring ground preparation					
Tillage[3]				$ 41	
Barley seed[4]				$ 6	
Herbicide & Application[5]				$ 18	
Seed	3	1,000,000 seeds	$ 100.00	$ 250	
Planting				$ 25	
Fertilizer					
Urea	200	lb	$ 0.25	$ 50	
P_2O_5	75	lb	$ 0.18	$ 14	
K_2O	350	lb	$ 0.13	$ 46	
Micronutrients[6]				$ 45	
Limestone	0.3	ton	$ 20	$ 7	
Applications	3	apps	$ 6	$ 18	
Scouting				$ 10	
Herbicide Materials[7]				$ 114	
Insecticide & Nematicide Materials[8]				$ 70	
Fungicide Materials[9]				$ 104	
Spray applications	15	apps	$ 7	$ 105	
Hand weeding	5	hours	$ 10.00	$ 50	
Cultivation				$ 8	
Irrigation[10]				$ -	
Sprout inhibitor and application[11]				$ 5	
Harvest					
Undercutting				$ 9	
Machinery[12]				$ 219	
Labor, skilled[13]	2	hr	$ 15.00	$ 30	
Labor, unskilled[14]	3	hr	$ 10.00	$ 30	
Boxes[15]				$ 88	
Storage[16]	300	bags	$ 0.19	$ 56	
Research check-off	600	bags	$ 0.03	$ 18	
Land rent				$ 200	
Insurance				$ 7	
Interest[17]	7%			$ 25	
Tool shed & repair overhead[18]				$ -	
Marketing, management & supervision[19]				$ 225	
TOTAL EXPENSES				**$ 1,894**	

FOOTNOTES

1	This yield is after storage shrink. Onions are sold in 50 lb bags.
2	Assumes one soil test every 2-3 years.
3	Includes spreading potash, moldboard plowing, broadcasting barley seed, dragging in seed and cultipacking for 4 total trips over the field.
4	Barley is planted with onions to protect seedlings from wind damage.
5	One application of Fusilade and a non-ionic surfactant to burn down the cover crop.
6	Includes primarily magnesium and manganese and may include zinc, copper and boron applied in conjunction with fungicides.
7	Includes 2 applications of Dual Magnum, 3 of Prowl, 1 of Buctril and 2 applications of Fusilade and a non-ionic surfactant.
8	Includes 1 application of Lorsban and 4 of Warrior.
9	Includes 3 applications of Rovral and 5 of Dithane.
10	Various types of irrigation are used on a small percentage of Michigan onion acres.
11	Includes a sprout inhibitor used on 1/3 of total acreage and application costs.
12	Assumes 2 $4,000 harvesters that harvest 120 acres a season, one machine hour each for 3 85hp tractors (2 for harvestors and 1 for pulling wagons), 2 wagons to transport bulbs to shed and 2 hi-los for loading and packing out.
13	Assumes 2 skilled laborers can cover one acre per hour during harvest.
14	Labor needed to sort out dirt and move from storage to pack out.
15	Assumes 28 20-bushel boxes per acre at $30 each with boxes lasting 20 years.
16	Assumes $0.063 storage cost per bushel for 3 months for half of marketed crop.
17	Operating capital assumed to be half of the variable costs (excluding custom charges) for half of the year.
18	These costs are included in custom rates.
19	Includes cost of marketing, management and supervision time and a vehicle for the manager.

Table 2. Expected fresh market onion net income (loss) per acre at selected price and yield combinations. Expenses covered DO NOT include sorting, packing or bagging onions.

	Yield, 50-lb bags				
Price	400	500	600	700	800
$ 2.50	$ (869)	$ (631)	$ (394)	$ (156)	$ 82
$ 3.00	$ (669)	$ (381)	$ (94)	$ 194	$ 482
$ 3.50	$ (469)	$ (131)	$ 206	$ 544	$ 882
$ 4.00	$ (269)	$ 119	$ 506	$ 894	$ 1,282