Field-Grown Bulb Crops:
An Economic Assessment of the
Feasibility of Providing Multiple-Peril Crop Insurance

Bulbs, Corms, Tubers, Rhizomes

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Executive Summary

The 1992 Census of Agriculture reported 993 farms with bulb crop sales. These farms had 1,004,474 square feet under protection, 8,428 acres in the open, and $52.5 million in bulb sales. Bulb crop production is concentrated in the West, especially in Washington, Oregon, and California. Nearly one-third of the farms and over 60 percent of the reported sales in 1992 were in these three states.

A special tabulation of the 559 farms reporting bulb sales in 1987 show that receipts from bulbs accounted for about one-fourth of the gross cash farm income on farms with bulb crops. Nearly all of the remaining receipts were from the sales of other greenhouse and nursery crops. The largest share of bulb production occurs on relatively few farms. In 1987, farms with total agricultural sales of $500,000 or more accounted for 61 percent of the bulb sales and about 50 percent of the acreage.

There are no reported estimates of the quantity of U.S. bulb crop production. The only aggregate production measures are sales and acreages. Currently, domestic grower sales are estimated between $50 and $75 million. About $10 million of U.S. bulb sales are exported annually.

The bulk of flower bulbs purchased in the United States are imported. Imports accounted for approximately $135 million in 1994, or about twice the domestic output. About 85 percent of U.S. imports are supplied by the Netherlands. Other foreign suppliers are Canada, Israel, and the United Kingdom.

U.S. consumption of bulbs is estimated at about $200 million annually at the wholesale equivalent level. About 60 percent of the bulbs are sold between August and October for fall planting. Most of the remaining volume is sold during the winter and early spring. Demand is generally low between May and July.

Most bulbs are grown in areas where the climate and soil provide a particular advantage for those varieties. A large bulb industry has developed west of the Cascade Mountain range in Oregon and Washington because of the temperate climate in that area. A wide range of bulb varieties can be grown there because the soil usually does not freeze enough to damage the bulbs and the abundant rainfall creates good growing conditions. Mild temperatures and abundant moisture favor the production of bulbs having a multi-year production cycle. In more severe climates, such as the Midwest and Northeast, tender bulbs must be removed from the soil in the fall and stored during the winter.

Most bulb crops are planted in the early fall, usually in September. Some varieties, such as gladioli, gloxinia, and begonia, are planted during the spring. The bulblets or small, immature bulbs remain in the ground for 1-3 years until they reach harvestable size. Some tender varieties in the Northcentral and Northeast regions require "lifting" or removal from the soil in the fall to avoid freeze damage.

Most bulbs are mechanically harvested using methods similar to those used for onions. The bulbs are lifted from the soil and deposited onto a belt-conveyor

that moves them into the harvester. The harvester shakes loose soil from the bulbs and they are placed into a bulk bin. Several workers on each harvester sort and grade, discarding damaged bulbs. Small bulbs are separated and may be used for planting the next crop. After harvesting, the bulbs are washed and cured. Although the timing of harvest is not specific, wet field conditions can delay harvesting and increase losses.

The major production perils in bulb production are excessive rain at harvest-time, excessive heat and drought, and unusually cold winter temperatures. Snow, ice, and hail also can reduce bulb crop yields. Excessive rainfall, in particular, is the main production problem for many bulb producers. Water-logged fields exacerbate rot problems, diminishing quality and reducing yields. Extended flooding can cause the complete loss of bulb crops.

Our assessment is that participation in crop insurance for in-ground bulbs is likely to be limited largely to participation in the catastrophic coverage plan. Bulb growers feel they can deal with most production problems through good management. The biggest losses in bulb production are due to flooding, and it is for this peril that some growers may want to purchase additional coverage.

Further, FCIC might want to require state inspection of bulbs as a condition for participationg in crop insurance to avert losses due to avoidable causes such as insects, diseases, or weeds. Typically, growers fumigate their fields with methyl bromide prior to planting to eradicate nematodes, but methyl bromide will be banned after the year 2000 and growers report they do not have an adequate alternative fumigant. FCIC might even require that soils be tested and shown to be acceptably free of nematodes.

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Introduction

The 1992 Census of Agriculture reported 993 farms with bulb crop sales. These farms had 1,004,474 square feet under protection, 8,428 acres in the open, and $52.5 million in bulb sales.

Bulb crops are grown for the production of cut flowers, potted plants, and for landscaping plants. Growers sell bulbs wholesale to commercial nurserymen and flower growers. Retail sales are through mail-order catalogs and other outlets.

This report examines those aspects of the U.S. bulb crop industry that relate to the demand for crop insurance and the feasibility of developing a field-grown bulb crop insurance policy.

The U.S. Bulb Industry

Bulb crop production is concentrated in the western United States, especially in Washington, Oregon, and California. Nearly one-third of the farms and over 60 percent of the reported sales in 1992 were in these three states. Sales data are either not available for many states or are not published to avoid disclosure.

Sixteen southern states reported one-third of the farms with bulb crops and 6 percent of U.S. sales. North Carolina and Texas are the major bulb producers in the South. Florida reported 76 farms with bulb production and 1,556 acres in bulb crops, but sales data were not released to avoid disclosure.

The Northeast and Northcentral regions each have about 15-20 percent of the farms, and each accounts for less than 5 percent of U.S. grower sales. Pennsylvania and New Jersey are the major producers in the Northeast, while Michigan, Missouri, and Ohio are the major producers in the Northcentral region.

A special tabulation of the 559 farms reporting bulb sales in 1987 show that receipts from bulbs accounted for about one-fourth of the gross cash farm income on farms with bulb crops. Nearly all of the remaining receipts were from the sales of other greenhouse and nursery crops.

Of the bulb-growing farms in 1987, 64 percent were individual- or family-owned proprietorships, 23 percent were family-held corporations, 10 percent were partnerships, and 3 percent reported other organizational types. Corporate ownership was typical for farms with $500,000 or more in sales, while individual or family ownership was most common among farms with less than $100,000 in sales.

Labor expenses are the largest single cost item for farms growing bulb crops. On average across the U.S., 41 percent of total cash farm expenses on bulb crop farms were for hired and contract labor.

The largest share of bulb production occurs on relatively few farms. Farms with total agricultural sales of $500,000 or more accounted for 61 percent of the bulb sales and about 50 percent of the acreage. Farms with sales from $100,000 to $499,999 had 29 percent of the sales and 26 percent of the acreage. The remaining farms, those with sales under $100,000, accounted for only 10 percent of the sales and 14 percent of the acreage.

Most operators of farms producing bulbs reported that farming was their principal occupation in 1987, especially operators of farms with over $100,000 in agricultural sales. Farming also was reported as the operator's principal occupation on a number of smaller farms. In some cases, small operations may be a part-time occupation for retired persons.

The Field-Grown Bulb Crop Industry

Although most states report some commercial production of bulb crops, Oregon, California, Florida, and Washington report the largest acreage in the open. Other states with 100 or more acres in bulb production in the open include Michigan, Missouri, New Jersey, North Carolina, Oklahoma, Tennessee, and Texas.

The major bulb growing counties and their 1992 value of sales include: Del Norte ($5,354,000) and San Diego ($509,000) counties in California; Clackamas ($959,000), Curry ($2,529,000), Marion ($5,910,000), Multnomah ($257,000), Washington ($254,000), and Yamhill ($340,000) counties in Oregon; Pierce ($587,000), Skagit ($4,297,000), Snohomish ($131,000), and Yakima ($95,000) counties in Washington; Gloucester County ($149,000) in New Jersey; Warren County ($95,000) in Tennessee; Duplin County ($933,000) in North Carolina; Allegheny ($83,000), Berks ($80,000), and Bucks ($642,000) counties in Pennsylvania; and Alachua ($524,000) and Highlands ($8,406,000) counties in Florida.

Some bulbs are grown in greenhouses or under some other protective cover. The 1992 Census reports 1 million square feet (about 23 acres) under glass or other protection in the United States. Most of the protected production is in Washington, Pennsylvania, and Ohio. Some of this reported "protective cover" is under temporary shade cloth or plastic cover that is subject to damage from high winds, hail storms, and flooding.

Bulbs

A true bulb is an enlarged, globular mass of scales. The scales may be tightly rolled in layers, one over the other, to form a hard, solid body much like an onion, or they may be loosely held together and merely connected to the basal or central core. Bulbs produce roots only from the base of their central core. The embryo of the next season's flower occupies a cavity within

the folds of the innermost layer of scales. A small, immature bulb is called a bulblet. A characteristic difference between true bulbs and corms or tubers is that bulbs consist of layers of scales, while corms and tubers consist of a solid mass of firm flesh, much like the texture of a potato.

The principal bulb crops grown in the U.S. are agapanthus (African lily), alstroemeria (Peruvian lily), amaryllis (hippeastrum), crocsomia (crocus), narcissus (daffodils), most lilies (asiatic, bugle, butterfly, calla, corn, easter, gloriosa, oriental), and tulip. Additional true bulbs grown in the U.S. include the allium, brodiaea, calochortus, camassias, chionodoxa, colchicum, crinum, eucharis, fritillarias, galanthus (snow drop), galtonia, haemanthus, hyacinth, hymenocallis, lachenalia, leucojum, milla, muscari, ornithogalum, puschkinia, scilla, sprekelia, sternbergia, tigridias, vallota, and zephyranthes.

Corms

Corms, like bulbs, produce roots from a common location at their base. Like tubers, however, corms store energy in a solid mass of cellular substance. Most corms exhaust their stored energy in producing a new plant, which produce new corms from which the next generation of plants are grown. The gladioli and montbretia are familiar examples of corms with such an annual life cycle. The cyclamen corm, however, is capable of perennial duration. Small, immature corms are called cormels. Other examples of corms are crocsomia (crocus), freesia, liatris, ixia, sparaxis, and watsonia.

Tubers

Tubers are enlarged underground stems adapted to storing energy and producing new plants. The reserve energy supports the tuber during a resting period and nourishes the young plant when new growth begins. New growth emerges from "eyes" on the tuber.

With some tuberous plants, such as the begonia and gloxinia, the eyes are closely grouped around a ring formed by the union of the first year's stem with the tuber. In other plants, such as anemones, the eyes are loosely distributed over the surface of the tuber. Tubers can be cut into pieces and new plants can be propagated from each piece having an eye. Dahlias, alstroemeria (Peruvian lily), gloriosa lillies, elephant's ear, and caladiums produce tuberous roots.

Rhizomes

The tubers of some plants are called rhizomes. Rhizomes are tubers that form root-like, subterranean stems, and are commonly horizontal in position. The subterranean stems produce roots below the stem and send up shoots from the top of the stem. Butterfly lilies, canna, and iris are examples of rhizomes (Macself).

The Bulb Crop Market

Supply

There are no reported estimates of the quantity of U.S. bulb crop production. The only aggregate production measures are sales and acreages. Currently, domestic grower sales are estimated between $50 and $75 million (Census of Agriculture and USDA/ERS). About $10 million of U.S. bulb sales are exported annually.

The bulk of flower bulbs purchased in the United States are imported. Imports accounted for approximately $135 million in 1994, or about twice the domestic output. About 85 percent of U.S. imports are supplied by the Netherlands. Other foreign suppliers are Canada, Israel, and the United Kingdom.

Demand

U.S. consumption of bulbs is estimated at about $200 million annually at the wholesale equivalent level. About 60 percent of the bulbs are sold between August and October for fall planting. Most of the remaining volume is sold during the winter and early spring. Demand is generally low between May and July.

Most of the foreign supply consists of tulips, lilies, gladioli, daffodils (narcissus), dahlias, hyacinths, and crocus. Although U.S. growers also produce these types, the major focus of the domestic industry is gladioli, lilies, cannas, caladiums, irises, begonias, and ranunculas.

Domestic and foreign-grown bulbs appear to be targeted for different market segments. Most of the imported bulbs are marketed through retail nurseries, garden centers, mail-order catalogues, and other consumer outlets. A large part of the domestic production, however, perhaps 35-45 percent or more, is sold to commercial growers who use them for growing potted flowering plants or for producing cut flowers.

Changes in personal disposable income have a discernable effect on the demand for bulbs. Bulbs are relatively high-priced non-essential items, and consumer purchases rise substantially when disposable incomes rise and remain more or less unchanged during periods of stagnant personal incomes.

Prices

The are no price series for bulbs published by the USDA or other federal agencies. Growers generally maintain their own wholesale/retail price lists. Prices are usually stable from season to season. If supply is excessive, growers can store their bulbs until next season when prices may be higher. Because bulbs can be stored for later sale, low prices and product perishability do not appear likely to create an incentive for moral hazard.

Cultivation and Marketing

Climatic Requirements

Most bulbs are grown in areas where the climate and soil provide a particular advantage for those varieties. A large bulb industry has developed west of the Cascade Mountain range in Oregon and Washington because of the temperate climate in that area. A wide range of bulb varieties can be grown there because the soil usually does not freeze enough to damage the bulbs and the abundant rainfall creates good growing conditions. Mild temperatures and abundant moisture favor the production of bulbs having a multi-year production cycle. In more severe climates, such as the Midwest and Northeast, tender bulbs must be removed from the soil in the fall and stored during the winter.

Soil Requirements

Some bulbs grow well in light sandy or gravelly-type soils. Most, however, grow best in loams with high organic matter content. Generally, bulbs do not grow well in water-logged or heavy clay soils.

Planting

Most bulb crops are planted in the early fall, usually in September. Some varieties, such as gladioli, gloxinia, and begonia, are planted during the spring. The bulblets or small, immature bulbs remain in the ground for 1-3 years until they reach harvestable size. Some tender varieties in the Northcentral and Northeast regions require "lifting" or removal from the soil in the fall to avoid freeze damage.

Most bulbs are field-planted in rows or beds at a depth of 2-3 inches and at a spacing of 6 inches apart. Some varieties are planted as close as 3 inches apart while 8- or 9- inch spacing may be needed for the largest bulbs. Beds may be similar to strawberry beds, which are 30-36 inches wide with 3-4 feet between bed-centers. This spacing allows sufficient room to move equipment through the field for cultivation and spraying and allows space for workers to weed and check for insects and diseases.

Growers usually apply pre-emergence herbicides and fumigate during soil preparation to control nematodes and soil-borne diseases.

Harvesting

Most bulbs are mechanically harvested using methods similar to those used for onions. The bulbs are lifted from the soil and deposited onto a belt-conveyor that moves them into the harvester. The harvester shakes loose soil from the bulbs and they are placed into a bulk bin. Several workers on each harvester sort and grade, discarding damaged bulbs. Small bulbs are separated and may be used for planting the next crop. After harvesting, the bulbs are washed and cured. Although the timing of harvest is not specific, wet field conditions can delay harvesting and increase losses.

The size and number of bulbs harvested depends mainly on the variety, season, and growing conditions. With varieties planted in single rows on 3-foot centers, about 750,000 bulbs are harvested; with double rows, 1.5 million bulbs are harvested; and from closely planted seedbeds, about 2 to 3 million bulbs are harvested.

Marketing Practices

Frequently, producers market their own bulbs. Some companies have mail-order businesses and sell to homeowners, landscapers, and other potential buyers. Producers may also grow bulbs under contractual arrangements with retail nurseries, mass merchandisers, exporters, or commercial flower growers.

Costs of Production

The only cost of production data available for bulb crops is that compiled from a special tabulation of the 1987 Census. Expenses for hired and contracted labor accounted for 40-45 percent of all cash farm expenses on bulb farms in 1987 (Table 2). The expenses for bulb production were similar to those for other field-grown nursery crops. The in-field value of bulb crops is estimated at about one-half of their wholesale market price.

Production Perils

The major production perils in bulb production are excessive rain at harvest-time, excessive heat and drought, and unusually cold winter temperatures. Snow, ice, and hail also can reduce bulb crop yields.

Excessive Rain and Flooding

Excessive rainfall is reportedly the number one production problem for bulb producers. Water-logged fields exacerbate rot problems, diminishing quality and reducing yields. Extended flooding can cause the complete loss of bulb crops.

Excessive Heat and Drought

Excessive heat and/or drought for an extended period cause plants to wilt and reduces bulb growth. The diminished growth increases the number of small bulbs, reducing the yield of marketable size bulbs. Heat and drought may also be associated with a higher incidence of insect activity, which can lower quality and sometimes make bulbs unsalable. Irrigation can eliminate the drought problem and help moderate temperatures.

Hail, Ice, and Snow

Excessive amounts of ice and snow, especially after the start of spring growth, can accumulate on the plants and cause breakage. Hailstorms also can

strip the plant of its leaves, reducing bulb growth and lowering yields. Usually, hail damage is local and limited to few growers.

Freezing Temperatures

Extremely low and/or sudden decreases in temperatures can cause the internal cells of the bulb to swell and burst. Cells that have burst create an avenue for the introduction of diseases.

Diseases

Some of the most serious diseases affecting bulb plants are narcissus disease, stromatinia (sclerotinia dry rot), curvularia trifolii (gladioli fungus), narcissi bulb eelworm, stemphylium (leaf spot fungus), pseudomonas marginata (bacterial scab and leaf blight organism), xanthomonas gummisudans (bacteria), septoria fungus, smut, mold, iris bulb scab, cucumber mosaic virus, iris rot, and bulb sclerotinia (Macself; Magie, Overman, and Waters). Generally, diseases can be controlled with careful attention to management, including the timely use of fungicides.

Insects and Animal Pests

The following insects can attack bulb plants: aphids, stem nematodes, root-lesion nematodes, narcissus bulb and leaf nematodes, potato tuber nematodes, leafhoppers, ants, thrips, mealybugs, weevils, leather jacket grubs, wireworms, red spider mites, dart moth caterpillars, symphylids, lily beetles, garden swift moths, sciarids, slugs and snails, narcissus flies, and bulb scale mites. Rats, mice, voles, deer, and other animals can also cause damage (Lane and Macself). Insect damage can generally be minimized with careful attention to management and the use of pesticides. Fumigation of the soil before planting is an important control for nematodes.

State Analyses

Washington

Washington reported the largest amount of field-grown acreage and greenhouse area in bulb production in the 1992 Census. Although the number of growers increased between 1987 and 1992, there are presently only about 16 major commercial producers in the state. Washington's acreage and sales of bulb crops also increased between 1987 and 1992.

Bulb crop production in Washington is relatively concentrated among large producers, with one company reportedly producing about 60 percent of the state's output. Washington growers produce a wide range of bulb varieties, including tulips, daffodils, lilies, irises, and gladioli.

Production Perils

The most serious production peril in Washington is flooding during the winter and spring, when some bulb fields may be inundated. Flooding promotes losses due to rotting. Disease and insect infestations also tend to develop following very wet conditions. Although not as serious as flooding, freezing temperatures and frosts periodically cause losses in Washington.

Demand for Insurance

Bulb growers would likely participate in the catastrophic insurance plan because of the minimal cost relative to the potential benefits. One contact indicated that he thought some growers would purchase buy-up coverage because of the potential for losses due to flooding (Roozen).

Florida

Caladiums and gladioli are the major bulb crops in Florida. Two crops of gladiolus can be harvested per year on a 5-6 month production cycle. Caladium bulbs are mostly planted in April and dug in November and December. Harvesting and marketing costs represent at least 50 percent of total production costs (McRoy, Hobbs and Hatch).

Production Perils

Frost or freezes and diseases, such as blight, are major production perils. The availability of labor for harvesting is usually not a problem in Florida.

Demand for Insurance

Florida growers would likely have only a minimal interest in crop insurance and are likely to only participate in the minimum catastrophic plan. A few growers may purchase the buy-up insurance for protection against losses due to freezing temperatures (McRoy).

Oregon

The major bulb crops grown in Oregon are tulips, iris, daffodils, and lilies. Lesser amounts of hyacinths, gladioli, alliums, and some specialty bulbs also are produced. Most production is located in the Willamette Valley, which lies west of the Cascade Mountain range. The climate west of the Cascade Mountains is relatively temperate with abundant rainfall, and usually is well adapted to bulb production. Oregon reported 129 growers in 1992 and 1,129 acres in the open.

Two years are generally required to produce bulbs of saleable size in Oregon. Sometimes growers combine bulb production with cut flower production, cutting and selling flowers during the bulb's production cycle. Producing cut flowers, however, delays the bulb's development and extends the production cycle.

Production Perils

Excessive cold spells, drought, and winter flooding are the major production perils. Generally, frost or flooding affects only a few fields because production is widely dispersed. Some growers use irrigation when very dry conditions occur and some use pumps to remove water from the fields in the case of flooding.

Demand for Insurance

Participation in crop insurance for bulb crops would likely be limited to participation in the minimum catastrophic coverage because growers do not face many extreme weather conditions (Nowdnick). A few growers may purchase insurance for protection against losses due to flooding.

Ad Hoc Disaster Assistance for Bulb Crops

Ad hoc disaster payments from 1988 to 1993 totalled $858,245, with most of the payments being made for the 1993 crop. (Appendix table 1). The largest payments were for losses of gladiolus corms due to flooding in Iroquois and Kankakee counties in Illinois, and for daffodil bulb losses in Pierce County, Washington.

Field-Grown Bulb Crop Insurance Implementation Issues

Adverse Selection

Adverse selection is not likely to be an issue in insuring bulb crops because most perils tend not to be field-specific, and growers and insurers are likely to have comparable information about risks. In most cases, growers will have historical records for establishing yield histories and actuarially-sound insurance premiums.

To the extent that adverse selection does occur, it is most likely to be associated with losses due to flooding. In some cases, flooding may be field-specific and the grower may have better information about the chances of flooding in a particular field than the insurer. Growers, consequently, could benefit from the insurer's incomplete information if premiums exceeded or fell short of expected losses.

Setting Reference Prices

Because of the scarcity of price data for bulb crops, reference prices may need to be based on individual growers' wholesale price lists.

Estimating "Appraised Production"

As with other field-grown nursery and floricultural crops, bulbs may be partially-salvageable following injury, and may have some remaining value for future use. By extending the growing cycle, growers may be able to harvest some bulbs from a damaged field or use the bulbs for planting a future crop. This creates a situation where growers could receive double payments, once when they receive indemnity payments for temporary damage and again when they harvest and sell the marketable bulbs.

A rule-of-thumb approach may be the most satisfactory approach to estimating appraised production (the remaining value of the crop following injury). The current containerized nursery policy uses such an approach, deducting 90 percent of the value of the damaged plants that are deemed marketable at a future point in time.

Market Prices and Moral Hazard

Moral hazard due to low market prices is less likely to be an issue in offering insurance to bulb producers than for some field-grown floricultural or nursery crops. If growers are not able to locate a buyer or if a market glut lowers prices, they can store their bulbs for a while until a buyer is found or prices increase.

Availability of Individual Yield Data

Growers, especially large operations, generally keep production and yield records. They know the number of marketable-size bulbs normally harvested per row and the number of rows per acre. There is, however, no consolidated database of individual-grower yield series available.

Demand for Insurance

Our assessment is that participation in crop insurance for in-ground bulbs is likely to be limited largely to participation in the catastrophic coverage plan. Weather-related perils generally have less serious effects on bulb crop yields than on yields for fruit and vegetable crops. In addition, bulb growers feel they can deal with most production problems through good management. The biggest losses in bulb production are due to flooding, and it is for this peril that some growers may want to purchase additional coverage.

Other Implementation Issues

FCIC might want to require state inspection of bulbs crops as a condition for participating in crop insurance to avert losses due to avoidable causes such as insects, diseases, or weeds. Typically, growers fumigate their fields with methyl bromide prior to planting to eradicate nematodes, but methyl bromide will be banned after the year 2000 and growers report they do not have an adequate alternative fumigant. FCIC might even require that soils be tested and shown to be acceptably free of nematodes. Inspection would benefit FCIC as well as growers by avoiding preventable losses due to pests and diseases.

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