Buckwheat: An Economic Assessment of the Feasibility of Providing Multiple-Peril Crop Insurance

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Executive Summary

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Introduction

Buckwheat is a broadleaf grain adapted to the cool, short-season conditions which prevail across the northern tier of the United States. It has been grown in America since colonial days, and was common on farms in the northeastern and north central states during the 19th century and early part of the 20th century. Output peaked at 22 million bushels in 1866, when more than a million acres were planted to the crop (Robinson). At that time, the grain was used for human consumption and was a common livestock feed.

Two species of buckwheat have been grown commercially at one time or another in the United States. They are common buckwheat, *Fagopyrum esculentum* Moench (also known as *F. sagittatum* Gilib.) and tartary buckwheat, *F. tataricum* Gaertn. Common buckwheat is the most widely grown today.[1] The leading buckwheat-producing states are North Dakota, South Dakota, Minnesota, Washington, New York, Montana, and Pennsylvania.

The Census of Agriculture reported 64,554 harvested acres of buckwheat in 1992, producing 899,632 bushels of grain (Table 1; Appendix table 1). Other data suggest that farmers may plant as many as 95,000 acres in some years (Table 2). The farm value of U.S. buckwheat output likely ranges from $4-$6 million annually.

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

The Buckwheat Plant

Even though produced and used as a grain crop, buckwheat is not in the grass family of plants that include true grains such as wheat, oats, and barley. Instead, it is a broadleaf plant in the *Polygonaceae* family and is related to weeds such

[1] Tartary buckwheat, sometimes called 'Indiawheat' or 'Duckwheat,' has a bitter taste that makes it undesirable for human consumption. Very little tartary buckwheat is grown in the U.S. today, although a small amount is produced for poultry feed and bird seed.

as smartweed, sorrel, black bindweed, and dock. Buckwheat is an annual that normally grows 2 to 4 feet tall. The plant has a single, hollow stem with numerous side branches. Its tap root is relatively short and has a smaller system of lateral roots than other grains. This makes the plant prone to falling over (lodging) and may be a contributing factor to the rapid wilting of buckwheat during hot, dry weather (Knapp; Robinson).

Buckwheat flowers develop on the ends of the branches and on short stems that arise from the axils of the leaves. The plant has an indeterminate growth habit, meaning that it continues to grow and flower until killed by frost. Consequently, all the seeds on a plant do not ripen at the same time. New flowers continue to bloom near the top of the stalk while ripe seeds are already present on the lower branches.

Buckwheat blossoms are primarily white, with a few being pink. Nectar glands located at the base of each flower make them very attractive to bees and other insects. This attraction is important because common buckwheat is self-sterile and must be cross-pollinated. The wind carries pollen from flower to flower, providing some cross-fertilization. However, grain yields rise when an abundance of bees are present during the bloom period, assuring substantial pollen transfer.

Buckwheat seeds are normally three-sided and their hulls range in color from shades of brown to gray and black. They vary considerably in size, shape, and density. A bushel of buckwheat may range in weight from 40 to 50 pounds, depending on the size and quality of the seed. In general, small-seeded buckwheat is heavier than large-seeded buckwheat.

Buckwheat Uses

Until a recent increase in interest in buckwheat for human food, about 75 percent of the grain was used for livestock and poultry feed and 5-6 percent was used for seed. The remainder was milled into flour (Oplinger, et al.). Today, however, buckwheat’s major use is for human food, with only a small amount grown for other purposes, such as livestock feed, use as a honey crop or green manure crop, or for weed control or wildlife plantings.

Human Food

The principal food use of buckwheat in North America is in pancake mixes, which contain a leavening agent and buckwheat,

wheat, corn, rice, and/or oat flour. In Japan and Korea, buckwheat is used primarily in flour for manufacturing buckwheat noodles, or “soba,” and as groats. Groats, that part of the grain left after the hulls are removed, and farina, made from groats, are used in breakfast foods and porridge, and as thickening agents in soups, gravies, and dressings. Buckwheat is also a basic food item in porridge and soups in eastern Europe.

Buckwheat is prized as a natural food because its nutritional value equals or exceeds that of the more common cereals. It has a high protein content and is rich in the limiting amino acid, lysine. In addition, its ‘natural’ aspect can be emphasized in marketing because it grows well with little fertilizer and without the use of chemical pesticides.

Livestock Feed

Buckwheat grain (either ground or rolled) makes a fairly good livestock feed when fed in combination with other grains. It has lower feed energy value than other grains and can cause some animals with white hides to develop a skin rash if regularly fed in large amounts. When used as feed, it is usually mixed at a rate of at least two parts corn, oats, or barley to one part buckwheat.

Tartary buckwheat has a lower feeding value than the more common varieties, but can be used as an ingredient in scratch feeds for poultry. The small, smooth, round seed of tartary buckwheat makes it more satisfactory as a poultry feed than the larger, more angular seeds of common buckwheat (Oplinger, et al.).

Honey Crop

Common buckwheat is sometimes planted as a honey crop.[2] It has a long blooming period in late summer and early fall, when other sources of nectar are scarce. Buckwheat produces a dark, strong- flavored honey that is highly favored by some people.

Weed Control

Buckwheat can be used as a smother crop for weed control when a farmer wishes to avoid using chemical herbicides. It

[2] Tartary buckwheat is a very poor honey producer and is not used in honey production (Taylor). Tartary buckwheat is self-fertile and will produce seed without cross-pollination (Robinson).

competes well with weeds because it germinates rapidly and forms a dense leaf canopy that shades the soil and smothers most weeds. Due to the availability of effective herbicides, however, the use of buckwheat as a smother crop is no longer as important as at one time.

Green Manure Crop

Buckwheat produces a significant amount of plant material over a short time period that can be plowed under to enhance organic matter and improve the tilth and moisture-holding capacity of the soil. It decays rapidly when plowed into the soil, making nitrogen and other nutrients quickly available for succeeding crops.

In addition, buckwheat is more efficient than most plants at extracting phosphorus from the soil. As a result, it has a unique advantage as a green manure crop because it converts phosphorus, which is generally unavailable, to an available form that can be used by the succeeding crop.

Wildlife Plantings

Several wildlife species make use of buckwheat for cover or food. Deer relish the grain and browse on it as soon as a few seeds develop. Pheasants, waterfowl, doves, wild turkeys, and numerous songbirds also eat buckwheat grain.

Medicine

The leaves of the buckwheat plant contain rutin, a drug used to reduce hemorrhaging from disease-weakened capillaries. Tartary buckwheat has a higher rutin content than common buckwheat, and was at one time cultivated for the production of rutin. Tartary buckwheat is no longer used for this purpose, however, as rutin is now produced synthetically or is derived from non-buckwheat species produced in foreign countries (Robinson).

Varieties

Little breeding work has been done on buckwheat and, as a result, only a handful of improved varieties are produced in the United States. Appendix table 2 provides a brief description of some of the varieties cultivated over the past 30 years.

Further, because buckwheat cross-pollinates, varieties tend to inter-mix over time until they no longer maintain their true varietal characteristics. Such buckwheat is simply called ‘Common’ buckwheat.

The Buckwheat Industry

Although buckwheat is grown throughout the northern U.S., the largest concentration of acreage is located in contiguous areas in west central Minnesota, northeastern South Dakota, and southeastern North Dakota (Figure 1). Approximately three-quarters of the U.S. buckwheat acreage is located in these three states.

The Census reported 1,029 farms growing buckwheat in 1992. Data reported to USDA's Farm Service Agency (FSA), however, indicate that 2,025 farms were certified as growing buckwheat in 1992. One factor potentially explaining the smaller number of Census farms is that operators may report multiple units as a single farm to the Census, while they certified each unit as a separate farm to FSA. The average acreage per farm helps substantiate this hypothesis. The average size of buckwheat plantings for Census farms was 62.7 acres, while the average for farms certified with FSA was only 45.6 acres.

There is a substantial amount of year-to-year variation in the number of farms certifying buckwheat acreage and in the amount of acreage certified. FSA certified acreage declined to 69,284 in 1993, down from 92,257 in 1992. And, the number of farms certifying dropped from 2,025 in 1992 to 1,685 in 1993. In South Dakota, the number of farms certifying acreage declined from 499 in 1992 to 296 in 1993.

This variability in acreage and in the number of farms may be due partly to the role of buckwheat in farmers' cropping plans. Buckwheat is at times grown as a "catch" or emergency crop, being planted when the remaining growing season is to short to plant other crops or when another crop has failed. The larger acreages of buckwheat in 1992 and 1995 may have been the result of increased emergency plantings due to unusually cold and wet spring weather those years, which delayed the planting of other grains in Minnesota and the Dakotas.

The Buckwheat Market

Supply

U.S. buckwheat production is likely 40-60 million pounds in most years. The Census of Agriculture reported 899,632 bushels (about 40 million pounds) of production in 1992. This is the only official estimate we found and may understate total buckwheat output. The Farm Service Agency, for example, certified 43 percent more buckwheat acreage in 1992 than recorded by the Census (Table 2). Although some of the acreage certified by FSA may not have been harvested, it seems

likely that the amount of harvested acreage exceeded that reported by the Census.[3]

Buckwheat production also likely exceeded that reported by the Census for 1992. In North Dakota, for example, the state FSA office estimated 1992 buckwheat production at about 480,000 bushels (22 million pounds), compared with 265,688 bushels (12 million pounds) reported by the Census.[4]

In addition to domestic production, the U.S. imports a small volume of buckwheat, depending on the size of the U.S. crop (Table 3). In 1994, for example, imports rose sharply to 26.6 million pounds, up from 2.2 million pounds in 1993. The sharp increase in imports in 1994 (which would approximately coincide with the 1993-94 marketing year) was likely due to a small crop in 1993, when acreage declined 25 percent from the year before. A high proportion of U.S. buckwheat imports originate in Canada.[5]

Demand

The bulk of U.S. buckwheat production is exported, primarily to Japan. In 1993, the U.S. exported 40.5 million pounds (Table 4). In addition to exports, buckwheat is consumed domestically as human food and as livestock feed. Also, an estimated 3 to 4 million pounds are used annually for seeding new plantings.

Prices

There are no official published prices for buckwheat. However, several sources are available providing unofficial estimates. One source is the Farm Service Agency, which develops price estimates for operation of the past ad hoc disaster assistance program and the current Noninsured Assistance Program (NAP). In the case of buckwheat, FSA's

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[3] Although FSA acreage certified in 1992 exceeds the Census estimate, the FSA numbers for 1993 and 1994 were much closer to the 1992 Census-reported number.

[4] The North Dakota State FSA office used a state average yield of 12.6 bushels per acre in administering ad hoc disaster assistance in 1992. Multiplying 12.6 bushels per acre by 38,096 acres yields a production estimate of 480,010 bushels.

[5] The U.S. also imports a small amount of buckwheat in the form of flour. Between 1993 and 1995, buckwheat flour imports amounted to less than one-half million pounds of grain equivalent.

state offices develop prices from whatever sources are available, including unofficial estimates developed by other agencies and informal surveys of prices paid by dealers.

A second source of prices are the buckwheat buyers. Minn-Dak Growers, Ltd. of Grand Forks, North Dakota, for example, reports the average contract price paid annually. Minn-Dak Growers is one of the largest U.S. buyers of buckwheat, contracting with growers throughout the Midwest for buckwheat and other specialty crops. Minn-Dak's contract prices may be higher or lower than the season average price, as cash prices may either exceed or fall short of the contract price depending on the supply-demand balance for that particular season. Contract prices, however, represent fairly close estimates of the season average price because the bulk of production is produced under contract. Minn-Dak estimates that 90 percent of the buckwheat in the U.S. is produced under contract (Edwardson). Following are the Minn-Dak contract prices for 1980-1995:

North Dakota Buckwheat Prices

Year	($/Cwt)
1980	8.50
1981	15.00
1982	12.50
1983	9.50
1984	13.25
1985	12.00
1986	10.00
1987	8.50
1988	8.00
1989	12.50
1990	12.00
1991	9.00
1992	10.50
1993	12.00
1994	12.50
1995	12.50

Environmental Requirements and Cultural Practices

Climate

Buckwheat produces the highest yields in a cool, moist climate, such as found in much of the northern tier of states. Although it can grow under a fairly wide range of conditions, it is quite sensitive to extreme cold and to extreme heat.

Buckwheat is easily killed by freezing temperatures and does not produce well in situations of high temperatures. Hot, dry weather, especially at bloom time, results in blasting (withering) of the flowers, which prevents seed formation and greatly reduces yields.

Soil Requirements

Buckwheat can be produced on a wide variety of soil types and tolerates low soil fertility. It usually produces higher per-acre yields on soils with low fertility than do other small grains. In fertile soils, however, other grains usually produce a higher per-unit feed value than does buckwheat.

Buckwheat has a higher tolerance to soil acidity than any other grain crop. It does not grow well on soils containing high levels of limestone.

On soils high in nitrogen, buckwheat may be prone to lodging due to excessive vegetative growth. Once lodged, a buckwheat plant does not return to an upright position and its grain is likely to be lost because it cannot be picked up by the combine or swather. Heavy clay soils make a poor buckwheat plant bed as heavy rains following planting may cause crusting and result in poor seedling emergence.

Fertilization

Buckwheat is a heavy user of phosphate and a light user of nitrogen. Fertilization recommendations in Minnesota are similar to those for oats and barley, ranging from 0-60 pounds of nitrogen, phosphorus, and potassium per acre, depending on soil nutrient availability (Hall and Stymiest). High levels of nitrogen increase the probability of yield loss due to lodging.

Planting

Buckwheat should be planted after the danger of spring frost has past, but early enough in the summer so that a harvestable yield matures before the first killing frost in the fall. Buckwheat blooms 4 to 6 weeks after planting and matures in 10 to 12 weeks. Since excessive heat during the bloom period causes the blossoms to abort, the crop is planted so that flowering occurs after the hottest, driest part of the season. In most buckwheat states, this means that the crop should be planted between early-June and mid-July. Planting later than July 15 in most areas increases the risk that an early frost will kill the plant before the seeds mature. In North Dakota,

the recommended planting dates are between May 25 and June 15 (Berglund, 1995).

Buckwheat is usually sown with a grain drill at a depth of 1 to 2 inches, although it may be broadcast and covered by lightly harrowing the soil. Shallower seeding is preferable if the soil is loose and moist. Seeding deeper than 2 inches usually results in poor stands.

Buckwheat seed is sown at a rate of 36-72 pounds per acre. The lower rate is usually adequate when drilling, but the higher rate is advisable for broadcast seeding. Lower plant populations result in stout plants that branch profusely and resist lodging. In contrast, stands that are planted too thickly produce spindly plants with few branches, and result in poor seed production and susceptibility to lodging.

Drought Tolerance

Dry conditions, hot winds, and other types of stress during blossoming can drastically reduce buckwheat yields by causing the plant to abort blossoms and seeds. Because of its indeterminate growth habit, short periods of moisture stress early in the bloom period may still result in acceptable yields from later-blooming flowers.

Crop Rotation

Buckwheat is frequently used as a “catch” or emergency crop, or is planted on land that is poorly suited for other crops. It serves ideally as a catch crop because it grows rapidly and matures early. It can be planted after a spring-sown crop has failed or when poor weather conditions have prohibited planting such crops on a timely basis. Buckwheat also can be double-cropped following cannery peas, winter barley, or other crops that are harvested by early July.

Certain conditions, however, limit buckwheat’s use as a catch crop. Because it is easily injured by herbicide residues, it may not work as a catch crop following a failed planting that has been herbicide-treated. Trifluralin and atrazine residues are especially harmful and can result in a complete crop loss.

In addition, growers generally avoid planting buckwheat following canola, mustard, or sunflower. These crops readily produce volunteer plants, which are impossible to control in the buckwheat field (Berglund, 1995).

Volunteer buckwheat plants also can be a problem for subsequent crops such as wheat, as seed from volunteer

buckwheat mixes with the wheat grain. Growers can follow buckwheat with grain crops in which herbicides can control the volunteer buckwheat without damaging the grain crop.

Harvesting

Because buckwheat flowers continuously until the plant dies, immature seeds can be found on the plants at harvest. Therefore, the crop is harvested when the maximum number of seeds are ripe and the plants have lost most of their leaves. Extension guides generally recommend that buckwheat is ready for harvest when 75 percent of the seeds have turned brown or black (Berglund, 1995; Hall and Stymiest; Robinson). If buckwheat is harvested too early, the large number of green seeds cause storage problems. On the other hand, delayed harvesting results in excessive shattering. Once the plant has been killed by frost, the seeds shatter more easily and the crop should be harvested as soon as possible to minimize losses.

Buckwheat may be combined directly or it may be cut and swathed (windrowed) for further drying before combining. After the grain dries to approximately 16 percent moisture, it is then threshed by using a pick-up attachment on the combine. In general, buckwheat is direct combined in the Northeast, where frequent rain makes it risky to swath and dry the grain before combining. In the Midwest and West, it is more common to swath and dry the buckwheat before combining.

Yields

The major factors determining buckwheat yields include local growing conditions, variety, soil type, and management practices. The harvested acreage and production reported by the Census of Agriculture implied an average yield of 13.9 bushels (about 640 pounds) per acre in 1992 (Table 1).[6] A great deal of variation existed around this average, however, as state yields ranged from a low of just over 8 bushels in New Jersey to a high of over 42 bushels in Washington. For the major buckwheat states, average yields ranged between 10 and 15 bushels per acre.

Yields for individual growers vary more than the average among states. In North Dakota, for example, growers report yields of 0 to 2,000 pounds an acre (Berglund, 1996). In variety

[6] The weight per bushel of buckwheat varies considerably depending on the variety and grade of the grain. North Dakota state grain standards specify minimum test weights ranging from 40 pounds a bushel for No. 3 grade large-seeded buckwheat to 48 pounds for No. 1 grade small-seeded varieties. Unless otherwise stated, conversions in this report are based on a grain weight of 46 pounds per bushel.

trials conducted at one North Dakota experiment station, yields ranged from a low of 181 pounds an acre in 1991 to a high of 3,020 pounds in 1992.[7]

Yields typically range from 500 to 2,000 pounds an acre in Wisconsin and Minnesota. In variety trials from 1982 to 1987, average yields for three varieties ranged from 1,003 to 1,124 pounds per acre. In New York, yields commonly range from 4 to 40 bushels (184-1,840 pounds) per acre, with an average of about 16 bushels (736 pounds)(Bjorkman).

Minn-Dak Growers, Ltd., located in Grand Forks, North Dakota, reports a fairly wide year-to-year range in the average yield for North Dakota (see below). In 1985 and 1987, for example, the average yield exceeded 800 pounds an acre, compared with 170 pounds in 1988 and 235 in 1989. North Dakota experienced extreme drought during the summer of 1988, which lowered crop yields.

Yield Per Acre In North Dakota

Year	(pounds per acre)
1980	465
1981	539
1982	431
1983	415
1984	376
1985	811
1986	632
1987	807
1988	170
1989	235
1990	414
1991	500
1992	328
1993	402
1994	430
1995	450

Storing Buckwheat

Buckwheat's quality deteriorates continually during storage, and it should be sold in the marketing year in which it is harvested, preferably within a few months of harvest.

[7] The variety trials were conducted at Hettinger, North Dakota and reported in Berglund, 1995.

Buckwheat groats darken after extended storage (they are a light color when fresh) and lose their desirable flavor (Mazza). Buyers in the food market prefer lighter-colored groats and discount the price for the older grain. Old crop and new crop buckwheat should never be mixed as the dark groats of the old buckwheat lower the grade of the new buckwheat.

When cool conditions (under 50° F) are present, buckwheat can be store at 16 percent moisture or less for short periods of time. For longer-term storage, however, the moisture content must be lowered to 13 percent or less.

Grading and Quality

Buckwheat grade standards are set by individual states. In North Dakota, for example, the official grade standards specify quality requirements for Grades 1, 2, 3, and Sample Grade. The grade factors specify the minimum pounds per bushel and maximum limits for foreign material (N.D. State Seed Department). Sample grade is used for buckwheat which has any commercially objectionable foreign odors, is musty or sour, or is heating, hot, or otherwise unfit for the higher grades.

Marketing

Buckwheat is almost always grown under contract with the seed of the preferred variety furnished by the contracting company. Various sources judge that 90 percent or more of U.S. production is grown under contract (Edwardson; Berglund, 1996).

Buyers either sell to domestic millers or export the buckwheat grain. Japan is the major export market. New markets in Japan and increased use of buckwheat for its grain fiber and protein content in the U.S. have boosted demand for domestic buckwheat in recent years.

Costs and Returns

Buckwheat frequently does not provide a high enough economic return to be grown as the sole crop on a given parcel of land. As a result, it tends to be double-cropped after a small grain in areas were soybeans are a poor double crop, or as an emergency crop where the intended crop has failed.

Buckwheat is a relatively low-input, low-return crop. Although yields generally range upward to 40 bushels (about 1,840 pounds) an acre, 600 to 800 pounds appears to be more typical. Costs and returns budgets for Montana and North Dakota indicate direct cash expenses of approximately $41.00 an acre and indirect cash costs of $15-$20 per acre (Table 5). The net returns to the land investment and operator's labor and management were estimated at $56.06 per acre in North Dakota and $60.45 per acre in Montana. Returns above all direct costs were $28.29 and $34.55. Detailed budgets are contained in Appendix A.

Extension agronomists estimate that buckwheat will produce 800-1,200 pounds an acre in Missouri, and at 10 cents a pound, the gross return would be $80-120 an acre. Reportedly, this gross return does not cover both variable costs and land costs in Missouri (Myers).

In Pennsylvania, buckwheat produces about 1,000 pounds an acre, yielding about $100 in gross returns (Hatley). Although this return may not cover all fixed and variable costs, it yields a positive net return over cash variable expenses.

Production Perils

Although several situations may lead to crop failure, extended hot, dry conditions during the bloom period are the most likely to cause major yield losses. Hail, flooding, and frost are other significant perils. Insects and diseases are of minimal concern to buckwheat growers.

Excessive Heat

Excessive heat during the blossom period causes buckwheat flowers to blast or abort. (Aborted flowers cannot produce grain.) The damage from excessive heat is exacerbated if high temperatures are accompanied by drought and windy conditions.

Drought

Buckwheat must have adequate moisture when the crop is blossoming and developing seed in order to produce good yields. Extended periods of dry weather, especially if accompanied by hot winds, cause high levels of flower and seed abortion (Berglund).

Wind Damage

Wind, in combination with excessively wet soil, is a contributing cause of buckwheat lodging. Excessive winds also may increase shatter losses in ripe buckwheat.

Heavy Rainfall

Heavy rainfall in the ten days after planting can crust the soil and reduce root development. This results in stunted plant growth and reduced yields. Crop stunting due to soil crusting may reduce potential yields by up to 50 percent (Bjorkman).

Heavy rainfall, especially if it is accompanied by winds, can be a contributing factor to lodging. Lodging complicates harvesting and may result in yield losses.

In addition, extended rainy periods at harvest-time may lower quality if the buckwheat has been cut and swathed. Wet conditions eventually cause quality deterioration in swathed buckwheat.

Pesticide Residues

Herbicide residues from a previous crop may injure buckwheat. This is often a problem when buckwheat is planted following a crop destroyed by hail. Buckwheat following corn, for example, is risky if atrazine was used on the corn, as buckwheat is extremely sensitive to residual atrazine. Some herbicides used on peas also remain in the soil and may injure buckwheat planted following the pea crop (Robinson).

Hail

Hail risks to buckwheat are about the same as for other field crops. Damage to plants range from minor set-backs to complete destruction, depending on when the damage occurs and on the intensity of the storm. Hail tears up the plants and destroys blossoms. Wind accompanying hail exacerbates the damage. Young plants may outgrow hail damage to produce a crop, but once the plants enter the flowering stage, they do not recover very well (Berglund, 1995).

Fall Frosts

Frost kills the buckwheat plant and stops grain development. Once the buckwheat plant has been killed by frost, the grain shatters easily and less grain can be recovered.

Weeds

Weeds usually are kept under control by the buckwheat plants if the field is thoroughly cultivated to destroy existing weeds prior to planting. Thorough cultivation permits the crop to become established in a weed-free environment. And, because buckwheat competes very well once it is established, it smothers any weeds that may later develop.

Insects

Wireworms and aphids may attack buckwheat, but they do little damage. Japanese beetles can be quite harmful when they feed on the flowers. The damage from feeding beetles, however, usually does not reach an economic threshold level.

Diseases

Generally, buckwheat does not suffer any serious disease problems. Although leaf spot and root rot sometimes infect buckwheat plants, they do not cause significant yield losses.

Animals and Birds

Deer, birds, and rodents all feed on buckwheat and reduce yields. Deer, in particular, can be quite damaging when they feed in fields of ripened grain. Plantings in fields near wooded areas are more likely to be damaged than those in open areas.

State and Regional Analysis

Northeast

New York and Pennsylvania are the major buckwheat-producing states in the Northeast. In New York, the largest concentration of acreage is located in the west central part of the state in Ontario, Seneca, Schuyler, Steuben, Tompkins, and Yates counties. The Census of Agriculture reported 2,520 harvested acres in New York in 1992. An extension agronomist in New York estimates that there may be as many as 7,000-10,000 acres planted to buckwheat currently (Cox).

The buckwheat area in Pennsylvania is in the northern and western quadrants of the state (those counties north of Interstate 80 and those west of Interstate 81). The growing season in these counties is too short for a second-crop of soybeans following a small grain, but long enough to produce buckwheat (Hatley). Consequently, buckwheat tends to be the crop of choice for second-cropping after a small grain.

Growers direct combine most of the buckwheat in New York and Pennsylvania rather than swathe and dry it. Extended rainy periods are quite common during September, and swathed buckwheat could be lost due to mold while in the swath.

Yields generally range from virtually zero to 40 bushels an acre in Pennsylvania. A typical average yield appears to be about 15 bushels.

The major production peril in the Northeast is excessive heat during the bloom period. Excessive heat causes the blossoms to blast (wither and drop to the ground without setting grain). Early fall frosts also were mentioned as a production peril. Frost kills the plant, which increases shatter losses during harvest.

As in most areas, the timing of planting is crucial for growing buckwheat successfully. As a general rule, buckwheat planted before July 1 in Pennsylvania runs an increased risk of enduring hot, dry weather during its bloom period. Buckwheat planted after July 15 runs a heightened risk of being killed by frost before the majority of the grain has matured and is ready for harvesting. As a result, the recommended planting window extends only for 2-3 weeks. There may be areas, however, where the optimal planting dates differ somewhat from this guideline. (See Appendix B for buckwheat planting dates.)

(Glenn: Demand for insurance?)

Upper Midwest

Minnesota, North Dakota, and South Dakota accounted for three-quarters of the buckwheat acreage reported in the Census in 1992 and 63 percent of U.S. production (Table 1). These states accounted for an even higher percentage of the acreage certified by the Farm Service Agency--85 percent of the certified acreage was reported in Minnesota and the Dakotas in 1995.

The Census reported 217 farms that harvested buckwheat in North Dakota in 1992, 246 in South Dakota, and 148 in Minnesota. Acreage is concentrated in counties in the southeast quadrant of North Dakota, the northeast quadrant of South Dakota, and west central Minnesota.

Frequently, buckwheat is grown as an emergency or catch crop in the upper Midwest, being planted when circumstances prevent the planting of a longer-season crop or when another crop has failed. Some growers also produce buckwheat as a regular crop in their planned rotations (Edwardson).

Hot, dry weather during the bloom period reportedly is the most serious production peril (Edwardson; Berglund; Stommes). Freeze damage before the crop matures is a hazard for late-

planted buckwheat. Growers can largely avoid this peril, however, by planting within the recommended planting window for their respective areas.

There is likely to be more demand for buckwheat crop insurance in the Dakotas and Minnesota than in any other area. These states have the largest acreage devoted to the crop, providing more potential demand than in other areas. In addition, farmers in this area shoulder larger investments in production expenses when planting buckwheat than farmers in other areas because they plant more acreage to the crop than farmers in other areas. (Glenn: I'm not sure this last sentence seems quite right to me. Wouldn't their fixed costs per acre be higher with fewer acres? Rather than absolute acreage, it seems to me that the insurance issue is associated with diversification.)

In addition, some banks require that farmers insure the crops for which they borrow production capital. Consequently, a number of farmers in the Dakotas and Minnesota would likely purchase buckwheat crop insurance as a condition for obtaining production loans. (Glenn: Would the lending requirement be more likely in Minnesota and North Dakota than in New York and Pennsylvania? Also, do you have a source for this?)

Ad Hoc Disaster Assistance for Buckwheat

Ad hoc disaster payments were made available to buckwheat growers for losses due to natural causes in each of the years 1988 to 1994. Since buckwheat was not eligible for crop insurance in those years, producers were required to realize a yield loss of at least 40 percent in order to be eligible for ad hoc disaster payments.

Data on ad hoc disaster payments provide an indication of potential high-loss areas. The states and counties with large ad hoc payments from 1988 to 1994 are most likely to face a relatively high risk of loss under a potential Risk Management Agency policy for buckwheawt, and would likely have a relatively high demand for crop insurance.

Disaster assistance payments for buckwheat losses totaled $4.0 million over the 1988-94 period (Table 6). The largest payments were made to North Dakota growers, who received 68 percent of total U.S. payments over the six-year period. These payments were due primarily to drought, extreme heat, and cold damage. (Glenn: Is this correct?) They were large compared to the state's 35 percent of U.S. acreage.

In contrast, payments to buckwheat growers in Minnesota and South Dakota were relatively low, at 0.6 and 13 percent of the U.S. total, respectively. This situation is particularly apparent when compared with these states' share of U.S. harvested acreage, with Minnesota accounting for 16 percent of the U.S. total, and South Dakota accounting for 28 percent of the total.

Insurance Implementation Issues

Demand for Insurance

We believe there would be substantial interest among commercial growers in purchasing buckwheat crop insurance. The greatest potential is likely to exist in the Dakotas and Minnesota because of the large concentration of acreage in this area and because farmers in this area sustain a larger investment in buckwheat production expenses than growers in other areas. (Glenn: See comment above.) Farmers frequently are required to insure their crop as a condition for borrowing production capital.

Buckwheat farmers in Montana and Washington also are likely to be interested in purchasing crop insurance for buckwheat for the same reasons as growers in the Dakota and Minnesota. Because of the small amount of acreage, however, there is a relatively small overall potential for buckwheat insurance in these states.

The RMA Regional Service offices in Billings, Montana and in St. Paul, Minnesota both indicate that they had several growers express interest in acquiring buckwheat insurance in the past, but that they had not received requests in the last several years. (Glenn: What about the demand for insurance in the Northeast?)

Moral Hazard

Moral hazard occurs when the insured intentionally (either through neglect or overt actions) contributes to causing a yield loss. Generally, a moral hazard incentives exists when net market returns from the additional yield fall below the returns from collecting crop insurance. This situation is most likely to happen when the expected yield is somewhat marginal and the market price for the crop is relatively low.

Moral hazard would not likely be a problem in insuring buckwheat. The bulk of the buckwheat is grown under contract with a dealer, and the price for this portion of the output is

set early in the season. For that portion of production not included under contract (the overage produced), market prices and yields are not likely to both be low at the same time.

In years in which yields fall below the yield guarantee, market supplies are likely to be relative tight and market prices, therefore, would probably exceed the established price set by RMA. There would not be an incentive for moral hazard in such situations, since market returns from incremental production would exceed crop insurance payments from incremental losses.

Adverse Selection

Opportunities for adverse selection arise when the insurer is unable to accurately reflect individual producers' risk structure in setting premium rates. To the extent that opportunities for adverse selection occurs with all insured crops, it also will occur with buckwheat. However, we see no reasons for adverse selection to be any greater problem in insuring buckwheat than in insuring any other new crop.

Reference Prices

We found no official market prices reported for buckwheat. The bulk of the buckwheat grown for grain is produced under contract with dealers. Some dealers compile an average contract price and make it available to interested parties. Also, the state FSA offices in buckwheat-growing states must estimate state average prices for buckwheat in the operation of the Noninsured Assistance Program. RMA could use these prices in developing price elections for buckwheat insurance. (Glenn: Does FSA have to estimate expected prices for a crop if there are no losses? I do not recall seeing buckwheat on the list of NAP-paid crops to date, and am surprised that FSA would estimate a price unless it were to be used imminently.)

Estimating "Appraised Production"

Appraised production refers to potential production lost due to uninsured causes or failure to follow recognized good farming practices, as well as production put to other than grain uses, and unharvested production. The procedures used in estimating appraised production for other grains should be adequate for buckwheat. A unique problem may arise for buckwheat, however, because of the indeterminate growth habit of the plant.

Regardless of when the buckwheat plant is harvested, some of its potential production is not recovered, due to shattering

of early-maturing seeds or because of immaturity of later-maturing grain. Growers time the harvesting operation to maximize the yield considering that some of the seed will be lost to either shattering or immaturity (see section on harvesting). Appraised production would need to be determined during the period when the plants are at the recommended stage of maturity for obtaining their maximum yield potential. (Glenn: You asked for other ideas. Shattering would be associated with moral hazard, but it seems as though moral hazard may not be a big enough concern to mention it.)

Yield Data

Dealer records of producer deliveries are likely to be the best source of data on individual growers' production. RMA will likely have to rely on the farmers' own estimates of the acreage associated with production, however. The county FSA offices have records of planted acreage for growers certifying their crop acreage. Most buckwheat growers in the upper Midwest certified their acreage with their county office. These data can serve as one source of checking farmers' reported acreage histories.

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Table 1--Buckwheat: Harvested area, yield and production, 1992

State	Harvested acres	Yield	Production
	Number	---------Bushels----------	
Illinois	1,503	18.6	27,946
Indiana	83	17.6	1,460
Iowa	26	9.6	250
Maryland	35	40.1	1,405
Michigan	640	8.8	5,621
Minnesota	10,114	12.9	121,403
Montana	2,222	11.1	24,651
New Jersey	7	8.1	57
New York	2,520	13.5	34,085
North Dakota	21,847	12.2	265,688
Ohio	230	19.7	4,537
Oregon	60	24.3	1,458
Pennsylvania	2,087	14.5	30,335
South Dakota	17,726	10.2	180,029
Washington	3,865	42.1	162,887
West Virginia	87	12.6	1,100
Wisconsin	496	17.9	8,891

Other States	1,006	27.7	27,829
United States	64,554	13.9	899,632

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Source: U.S. Department of Commerce, Bureau of the Census.

Table 2--U.S. Buckwheat: Number of farms certifying and certified acreage, 1992-95 [1]

State	1992	1993	1994	1995
	Number of farms			
Illinois	54	117	74	87
Minnesota	246	211	170	224
Montana	33	34	32	23
New York	167	180	148	134
North Dakota	527	410	437	591
Pennsylvania	156	149	174	162
South Dakota	499	296	348	395
Washington	5	7	12	5
Other	338	281	209	221
United States	2,025	1,685	1,604	1,842
	Acres			
Illinois	1,134	3,141	2,035	2,638
Minnesota	13,696	10,014	9,997	15,221
Montana	3,568	3,116	2.797	1,970
New York	2,551	3,303	2,714	2,308
North Dakota	38,096	27,675	27,898	40,712
Pennsylvania	1,630	1,646	2,234	2,007
South Dakota	26,553	13,785	17,743	25,345
Washington	738	1,370	1,528	226
Other	4,291	5,234	5,584	4,419
United States	92,257	69,284	72,530	94,846

[1] Excludes ‘failed’ acres.

Source: USDA, Farm Service Agency.

Table 3--U.S. buckwheat imports, 1993-95

	1993	1994	1995	1993	1994	1995
	----C.i.f.$1,000----			---Million pounds---		
World	318	1,412	1,115	2.2	26.6	5.1
Canada	183	1,039	570	1.3	24.8	3.2
Germany	3	0	0	*	0.0	0.0
Poland	49	114	119	0.3	0.3	0.4
Russia	0	23	410	0.0	0.1	1.4
Ukraine	0	0	18	0.0	0.0	*
Spain	2	0	0	*	0.0	0.0
Italy	0	5	0	0.0	*	0.0
China	61	221	0	0.4	1.4	0.0
Japan	23	13	0	0.1	*	0.0

* = Less than 50,000 pounds.

C.i.f. value is the landed value at the port of entry, and consists of the foreign market value, plus freight, insurance, and other charges incurred in moving the commodity to the U.S. port. It does not include duties on the imported product.

Source: U.S. Department of Commerce, National Trade Data Bank and Economic Bulletin Board, products of STAT-USA.

Table 4--U.S. Buckwheat exports, 1991-95

Country	1991	1992	1993	1994	1995	1991	1992	1993	1994	1995
	FAS $1,000					Million pounds				
World	7,151	5,306	5,703	6,183	6,308	58.8	44.1	40.5	33.5	40.3
Canada	174	181	562	235	85	1.6	1.7	3.9	2.8	0.9
Mexico	0	0	12	14	36	0	0	*	0.1	0.3
Guatemala	0	0	0	0	13	0	0	0	0	0.1
El Salvador	0	0	183	0	0	0	0	2.9	0	0
Haiti	0	0	0	0	61	0	0	0	0	1.9
Argentina	0	0	18	0	0	0	0	*	0	0
Sweden	5	0	0	36	0	*	0	0	0.1	0
Netherlands	170	278	587	292	494	0.5	1.3	3.9	1.2	2.7
Belgium	100	0	0	0	77	0	0	0	0	0.3
Germany	11	28	172	11	39	*	0.1	0.9	0.1	0.2
Italy	18	0	0	0	0	0.1	0	0	0	0
Israel	29	0	0	0	0	*	0	0	0	0
China	0	0	0	143	57	0	0	0	1.1	0.5
Korea	0	21	0	0	0	0	0.2	0	0	0
Taiwan	7	5	5	0	0	*	*	*	0	0
Japan	6,641	4,795	4,169	5,440	5,451	55.5	40.8	28.8	28.0	33.4
New Zealand	0	0	0	12	0	0	0	0	0.1	0

* = Less than 50,000 pounds.

F.a.s value = free-alongside-ship at the U.S. port of export, based on the transaction price and including inland transportation, insurance, and other costs.

Source: U.S. Department of Commerce, National Trade Data Bank and Economic Bulletin Board--products of STAT-USA.

Table 5--Buckwheat cost and returns in North Dakota and Montana, 1996

Item	North Dakota (1996)	Montana (1989)
	----------Pounds----------	
Yield	685	1,000
	--------$ per acre--------	
Returns	84.35	95.00
Cash Costs:		
Direct, variable	41.92	40.80
Indirect, fixed *	15.14	19.65
Total	56.06	60.45
Returns to land and operator labor and management:		
Over direct costs	42.43	54.20
Over direct and indirect	28.29	34.55

* North Dakota estimate excludes land charges and family living draw.

Source: Edwardson; Smith and others.

Table 6--Disaster assistance payments for buckwheat, 1988-94

U.S. State disaster payments[1]	Acreage harvested, 1992	Share of U.S. acreage[1]	Total disaster payments, 1988-94	Share of U.S.
	Acres	Percent	$1,000	Percent
Idaho	na	na	1.7	*
Illinois	1,503	2.3	134.6	3.4
Indiana	83	0.1	17.5	0.4
Kentucky	na	na	31.0	0.8
Maine	na	na	11.7	0.3
Maryland	35	0.1	0.8	*
Michigan	640	1.0	4.7	0.1
Minnesota	10,144	16.0	25.5	0.6
Montana	2,222	3.5	236.8	5.9
Nebraska	na	na	90.9	2.3
New Hampshire	na	na	0.1	*
New York	2,520	4.0	110.2	2.8
North Dakota	21,847	34.5	2,722.8	68.0
Ohio	230	0.4	22.8	0.6
Pennsylvania	2,087	3.3	36.9	0.9
South Dakota	17,726	28.0	514.8	12.9
Tennessee	na	na	0.7	*
Washington	3,865	6.1	15.2	0.4
West Virginia	87	0.1	3.1	0.1
Wisconsin	496	0.8	21.4	0.5
19 States	63,281	100.0	4,003.2	100.0

* = less than 0.05 percent. na = not available.

[1] May not add due to rounding.

Source: U.S. Department of Commerce, Bureau of the Census and FSA data files, compiled by the General Accounting Office.

Appendix table 1--Buckwheat: Number of farms, acres harvested, and acres irrigated, 1987 and 1992

State/County	1992				1987	
	Acres	---Irrigated---		Acres	---Irrigated---	
	Farms	Farms	harvested	Farms	Farms	harvested
Minnesota	148	10,114		--	--	
	220	9,308	--	--		
Crow Wing	8	485		--	--	
	6	104	--	--		
Douglas	14	224		--	--	
	32	728	--	--		
Otter Tail	40	4,515		--	--	
	53	3,334	--	--		
Pope	8	938		--	--	
	19	625	--	--		
Roseau	8	778		--	--	
	--	--	--	--		
Other	70	3,174		--	--	
	110	4,517	--	--		
Montana	14	2,222		--	--	
	6	632	--	--		
New York	98	2,520		4	17	
	224	5,607	--	--		
North Dakota	217	21,847		--	--	
	345	37,322	--	--		
Barnes	3	512		--	--	
	--	--	--	--		
Dickey	14	1,290		--	--	
	30	2,722	--	--		
Dunn	4	580		--	--	
	--	--	--	--		
Hettinger	6	1,159		--	--	
	50	11,454	--	--		
La Moure	31	4,255		--	--	
	26	1,097	--	--		
Logan	12	897		--	--	
	10	439	--	--		
McHenry	8	926		--	--	
	--	--	--	--		
McIntosh	29	2,903		--	--	
	7	313	--	--		
McLean	16	1,081		--	--	
	45	4,949	--	--		
Stutsman	24	2,707		--	--	
	5	420	--	--		
Wells	8	675		--	--	
	3	455	--	--		
Other	62	4,862		--	--	
	169	14,663	--	--		

Pennsylvania	118	2,087	--	--	--	--	228	5,179
Cambria	15	118	--	--	--	--	17	480
Indiana	11	167	--	--	--	--	15	327
Montour	4	197	--	--	--	--	8	239
Northunberland	4	529	--	--	--	--	24	1,388
Other	84	1,076	--	--	--	--	164	2,745
South Dakota	246	17,726	--	--	--	--	193	15,056
Codington	51	3,934	--	--	--	--	29	1,185
Day	60	4,250	--	--	--	--	42	3.901
Deuel	25	1,287	--	--	--	--	16	514
Grant	23	1,695	--	--	--	--	20	1,889
Marshall	7	619	--	--	--	--	3	201
Roberts	42	2,748	--	--	--	--	25	1,427
Other	35	2,663	--	--	--	--	58	5,939
Washington	22	3,865	15	1,477	19	3,717	16	1,547
U.S.	1,029	64,554	22	1,539	31	3,973	1,513	81,206

-- = Not available.

Source: U.S. Department of Commerce, Bureau of the Census. 1992.

Appendix table 2--Selected buckwheat varieties grown in the United States in recent years

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Mancum: Large-seeded diploid variety. Has low test weight but good market acceptance. Released by Agriculture Canada and licensed in 1974.

Manor: Large-seeded diploid variety. Has low test weight but good market acceptance. Released by Agriculture Canada and licensed in 1980. Production of certified seed is limited to Canada.

Pennquad: Very large-seeded tetraploid variety. Has good lodging resistance. The grain is especially well suited for milling because of its large, uniform size. Released by the Pennsylvania Agricultural Experiment Station in 1966.

Tempest: Small-seeded diploid variety with high test weight. Selected by Agriculture Canada from a Russian seedlot and licensed in 1971.

Tokyo: Small-seeded diploid type with high test weight. Developed by Agriculture Canada from a Japanese introduction.

Winsor Royal: Large-seeded diploid type with low test weight, but has good market acceptance. Released by Winsor Grain Company, Minneapolis, Minnesota, in 1982. Sale of seed is regulated by the U.S. Variety Protection Act.

Common: Seed lots tested under this name range from small to medium in seed size and often have medium to high test weight.

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Source: Oplinger, et. al.

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Appendix A

Cost of Production Budgets for Buckwheat

Montana

North Dakota

Appendix B

Buckwheat Planting Dates for New York and Pennsylvania