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G78-426 Popcorn Production

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Popcorn Production

This NebGuide addresses seed selection, soil requirements, production management, pest control, marketing and sale of popcorn.

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Commercial popcorn production in the United States has always been concentrated in the Corn Belt. Iowa was the largest popcorn producer until the mid 1940s. As hybrids replaced open-pollinated varieties, popcorn production shifted to Illinois then to Indiana. During the mid 1970s popcorn production moved west, and in 1977 Nebraska became the nation's largest producer. During the 1980s popcorn acreage has fluctuated among states, but Nebraska often has had the nation's highest yield because 85 percent of its crop is irrigated.

Hybrid Selection

Popcorn growers have shifted from open pollinated varieties to hybrids because of the improved yield, better standing ability, better popping expansion, and more uniform kernel type and maturity.

There are three types of popcorn kernels: white, small yellow, and large yellow. White popcorn has a rice-shaped kernel and yellow popcorn kernels are pearl-shaped. The three kernel types meet different needs within the industry. Growers and processors should consider this when selecting a hybrid. Industry standards have not been developed for kernel size determination. A common measure is based on the number of kernels in 10 grams. Large has 52-67 kernels, medium 58-75, and small, 76-105.

Another major consideration in hybrid selection is maturity. Maximum popping potential of a hybrid can be achieved only if it reaches full maturity. Therefore, growers should select only hybrids that can be expected to mature before frost. If planting is delayed, consider an earlier-maturing hybrid or an alternative crop. In fields where the harvested crop is to be used as seed next year, dent sterility is important because it prevents crossing with dent and sweet corn. Such outcrossing will affect the popping quality and total crop appearance. In fields where the harvested crop is to be used for popping, it's unnecessary to isolate popcorn from other types of corn, even if the popcorn is not dent-sterile. Pollen from other corn does not affect the popping ability of popcorn hybrids.

To aid in hybrid selection, yield and performance trial results from North Bend, Neb. are available from Purdue University, West Lafayette, Ind. The results are published annually in a Purdue University bulletin, *Hybrid Popcorn Performance Trial*. Popcorn breeding efforts at the University of Nebraska started in 1983. Recently two sources of popcorn germplasm (NP86 and NP87) were released and are being used in private breeding programs.

Cultural Practices

Land preparation for popcorn is similar to that for field corn. The most common method is to use two or three tandem diskings, although some heavy soil types will produce better if plowed. Disking or field cultivating is then used for seedbed preparation. If needed, a spike-tooth harrow or other finishing tool can be used with the last pass over the field to smooth the seedbed.

Soil Requirements

Any soil type suitable for dent corn should produce a good popcorn crop. Popcorn seed germinates more slowly than dent corn, and the seedlings grow more slowly. Thus, medium to coarse textured soils which warm slightly faster than fine-textured soils should improve germination, emergence, and seedling establishment.

The popcorn root system is less extensive than that of dent corn. Therefore high clay soils and/or poorly drained soils will weaken the roots, reduce yield, and increase lodging.

Fertility

Fertility requirements for popcorn are similar to dent corn. Soil pH should be in the range of 6.0 to 6.8. Use nitrogen rates of 150-200 pounds per acre for production. Nitrogen requirements are based on expected yield. In general the rate is 85 percent of the requirement for an expected yield of dent corn in the same field. Any dent corn fertilizer program adapted to popcorn production should take into consideration popcorn's relatively poor standing ability. High nitrogen rates can cause lodging, especially when using less than the recommended rate of potash. Also, because popcorn seedlings grow slower than dent corn, a starter fertilizer is probably important. Other nutrients are supplied according to need as shown by soil test, similar to dent corn requirements. For more information about fertility recommendations, see NebGuide: *G74-174, Fertilizer Suggestions for Corn*.

Planting

Popcorn can be planted from the last week in April to May 15. A soil temperature of 50-55° Fahrenheit is necessary. Planting later than May 15 often results in a reduction of yield and maximum popping expansion. Early planting permits the crop to mature and reach the desired harvesting moisture of 15-18 percent by early to mid-October. A clod-free seedbed with good tilth will ensure coverage of the seed just deep enough (1-2 inches) to be in contact with moist soils. For plate planters, special plates are required. Follow manufacturer's recommendations.

Seeding

Seeding rates for popcorn are higher than for dent corn because of its smaller plant size and lower yield. Generally, consider a 0-25 percent increase above the recommended dent corn plant densities for most soils and cultural practices. Row widths of 30 to 38 inches are common. Plant population at harvest varies with the hybrid used. With irrigation, the population should be from 20,000 to 27,000 plants per acre. A slightly lower population is used for dry land. Both seed size (number of kernels per pound) and grade should appear on the popcorn seed bags.

Irrigation

Irrigation of popcorn is the same as for field corn. Some growers like to delay early irrigations to stimulate better rooting of the developing plants; however, the value of this practice has not been determined. Watering during pollen shed is not recommended. Watering should continue until the black-layer has formed in the developing kernel. Information on scheduling techniques can be found in NebGuides *G77-340, Scheduling Irrigations by Electrical Resistance Blocks*, *G78-421, Water Measurement Calculations*, and *G85-753, Irrigation Scheduling Using Crop Water Use Data*.

Cultivation

Cultivation is usually one rotary hoeing, if weed control requires it, followed by one or two cultivations. Mechanical cultivation will depend on herbicide effectiveness. Hilling for gravity irrigation is the same as for field corn. Because popcorn produces fewer brace roots than field corn, hill or lay-by cultivation may help prevent lodging of popcorn under sprinkler irrigation.

Weed Control

For weed control use herbicides with a label clearance for popcorn. The predominant application method is with planting or before emergence. Details of herbicide recommendations are given in *EC-130, A Guide for Herbicide Use in Nebraska*, which is revised annually. Follow the recommendations for field corn for late season control of problem weeds. Always apply as directed on the herbicide label.

Insect Control

Most, if not all, of the insects that attack field corn can also attack popcorn. The NebGuide publication *G89-904, Corn Insects -- Quick Reference* provides short descriptions of all the economically important corn insect pests in Nebraska. The *EC90-1509, Insect Management Guide -- Corn and Sorghum* published yearly by the Nebraska Cooperative Extension offers suggestions for selecting an insect management program. Insecticides for corn rootworm control are necessary in some fields of continuous corn. Application rates are similar to those for field corn, and the insecticide used must be labelled for

popcorn. Specific recommendations for corn rootworm control are given in *EC1563, Corn Rootworm Management*. Insect control during the season is important, especially for European corn borers.

Diseases

In general popcorn has disease problems similar to those listed for field corn in the *National Corn Handbook (1971)*. However, popcorn is more susceptible than field corn to Goss's bacterial wilt. The UNL breeding program is making a concerted effort to incorporate resistance to Goss's Wilt. Recently, severe damage resulting from head smut infection has been reported in Nebraska. Blue eye disease caused by three types of molds *Penicillium viridicatum*, *P. cyclopium* and *Aspergillus glaucus*, can infect stored grain and lead to low popping volume, low germination and sometimes a low level of toxicity. This disease is best controlled by proper aeration during storage.

Harvesting

Either ear or shelled popcorn may be harvested. Moisture at harvesting for ear corn should be 18-20 percent, for shelled corn, 16-18 percent. Harvesting equipment should be adjusted accurately and carefully so kernel damage is prevented. Damaged kernels do not pop properly and will cause a discount on the grain market. Use of rotary combines may help prevent kernel damage.

Depending on the proximity of the processing plant, the grain may be delivered directly at harvest or stored on the farm until delivery is requested. If on-farm storage is required, storage facilities must be clean and in good repair. Aeration is essential for extended storage. Generally, the delivery of the grain is at 14-15 percent moisture, so the storage and aeration facilities must be able to remove some grain moisture. Relative humidity of 70 percent will maintain the grain at the proper moisture. Kernels that are too dry will not pop properly. Remove dirt, cobs, and other foreign material at harvest.

Marketing

Popcorn is mainly produced under contracts which specify the hybrids and the acreages to be planted. The grower usually buys the seed through the contracting company. In 1988 there were nine popcorn processors in Nebraska located at Imperial, North Platte, Chapman, Aurora, North Bend, Neligh, North Loup, Bartlett, and Ainsworth. Some popcorn produced in Nebraska is processed in western Iowa.

Popcorn seed grown without a sales contract is difficult to market and is risky for farmers who do not have appropriate storage with good aeration. In 1988, about 16 million pounds or 10 percent of Nebraska's popcorn crop was sold on the open market. Some of the popcorn planted without a contract is used as silage or as ground popcorn seed (15 percent moisture) for feeding poultry, hogs and livestock. It is a cheaper protein source than field corn since it is usually cheaper than corn when sold on the open market as a feed grain. Usually the yellow kernel hybrids are preferred for this purpose.

Popping Quality

The quality of popcorn is expressed as popped volume, shape of the popped kernels, tenderness, and flavor. Only volume can be measured easily. The popped volume is perhaps most important because the commercial buyer buys by weight but sells the popped popcorn by volume. The conventional oil popping methods are still most common. However, air popping and microwave popping are becoming increasingly important in the retail market. Between 1986 and 1989 the sale of microwave popcorn increased from \$100 million to more than \$400 million. This tremendous increase has created an interest in evaluating microwave popping. Problems associated with low expansion volume, the high number of

unpopped kernels, and scorching of popped kernels make conventional popping superior to microwave popping. Popcorn variety, the moisture content of the kernels, storage conditions, type of package, and microwave oven wattage influence the quality of microwave popping.

Reference

Ziegler, K.E., R. B. Ashman, G.M. White, and D.S. Wysong. 1984. Popcorn Production and Marketing. Cooperative Extension Service, Purdue University, West Lafayette, Indiana. National Corn Handbook.

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