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GROWING SQUASH AND PUMPKIN

By L. G. P. Bouquet

These two important fall vegetables are frequently confused. Varieties of pumpkins may often be unknowingly called squash and sometimes the opposite is true. As a matter of fact, several varieties of true pumpkins have for years been called summer squash, as will be explained in the following paragraph. The grower should first be informed, therefore, as to the definition of a squash or a pumpkin and the characters positively identifying true squashes as such and true pumpkins.

In order to present this question clearly and without fear of confusion, it should be known that all squashes belong to the genus Cucurbita, sp. maxima, usually written Cucurbita maxima. To this group belong all the vining or running squashes such as Hubbard, Banana, Delicious, Golden Delicious, etc. These are the true squashes. They may be correctly identified because of having a round, cylindrical, smooth, rather soft spongy fruit stem which can readily be penetrated with the thumbnail.

The pumpkins belong to either Cucurbita pepo, or Cucurbita moschata.

Pumpkins are readily distinguishable from squash because of having at maturity a hard woody, rough fruit stalk which is rather distinctly furrowed longitudinally, and which may or may not be conspicuously enlarged at the attachment to the fruit. In the group Cucurbita pepo belong such varieties of pumpkins as Connecticut Field, Winter Luxury, Sugar Pie, as well as varieties of so-called summer squash (which are not squash at all) as Summer Crookneck, Pattypan, or Bush Scallop; also, varieties of the Vegetable Marrow, Cocozelle and Zucchini, and such well known fall varieties as Table Queen and Delicata. The latter are usually called squash when as a matter of fact they are true pumpkins.

In the group Cucurbita moschata are some important varieties of pumpkins represented mainly by large Cheese, Striped Cushaw and the Tennessee Sweet potato. The stems of the group Cucurbita moschata are somewhat similar to those of Cucurbita pepo, but usually there is quite an enlarged base of the stem where it attaches to the fruit.

It has been shown, therefore, that by the comparison of types of stems of the fruit, varieties can be determined as to whether they belong to the squash or pumpkin groups. It will be noted that there are no true squashes of the bush form, but that the pumpkins contain both the bush and running or vining varieties. It has also been pointed out that the so-called summer squashes as represented by Crookneck and the Scallops are in reality varieties of pumpkin.

The question is frequently asked, "Do varieties of pumpkin and squash cross in the field?" Experiments which have been conducted indicate that varieties of true squash, such as the Hubbard and others, rarely if ever cross with varieties of true pumpkins of the species pepo. One need not fear that there will be any crosses, therefore, if varieties of Delicious squash are growing alongside of Connecticut Field or Winter Luxury pumpkins, or that the varieties of true squash will cross with the so-called summer squashes, which as it has been pointed out are members of the same species as the Winter Luxury; namely, C. pepo.

In attempts, however, to cross true squashes with the other branch of the pumpkin family; namely C. moschata, crosses have been successful and a number of fertile seeds secured. It is therefore quite probable that such a variety of true squash such as Hubbard will cross with the large Cheese of the pumpkin group.

In other cases, too, it has been found that the two branches of pumpkins, namely C. pepo and C. moschata will cross and one is liable to get crosses, therefore, of such varieties as Connecticut Field with Large Cheese.

Within the same species, varieties will of course readily cross, that is, such varieties as Hubbard, Banana, Delicious and Golden Delicious, if planted near each other, will readily intercross in the field. Likewise, such varieties of pumpkins as Connecticut Field and Winter Luxury will cross with Table Queen, Crookneck, and other varieties belonging to the same species.

The knowledge of these various groups will assist the grower in determining whether it may be possible to combine the desirable characters of one variety and another. For example, there may be some desirable characters of the Cheese pumpkin for canning purposes which it may be desired to unite with the characters of such a variety as Golden Delicious. The latter belongs to the true squashes, C. maxima while the Cheese belongs to C. moschata, which, as it has been pointed out, will cross and make fertile seeds.

Varieties of squash. The choice of varieties will be determined largely by the character of the market which is supplied. During the past few years, there has been a tendency for types of smaller squash to be grown as having greater favor for retail sales in the city markets. For such, therefore, the small or Kitchenette Hubbard as also the Table Queen pumpkins have been grown. Larger varieties of squash which are often cut for retailing in small quantities include Hubbard, Delicious, Marblehead, Banana and Golden Delicious.

The Hubbard group includes the Green Hubbard, Chicago Warty Hubbard, Kitchenette Hubbard, Golden Hubbard. The Delicious group having top or heart-shaped fruit, pointed at the blossom end, includes the Delicious with dark green skin and the Golden Delicious which is the result of a cross between the Delicious and the Autumnal or Boston Marrow.

Marblehead is lemon-shaped, slightly pointed at the blossom end and having a bluish-gray skin and a thick, hard shell. It is a long-keeping squash and popular in the Portland market.

Banana is long, cylindrical, banana-shaped, having greenish-gray skin and a light orange flesh. The quality is excellent and the variety is deservedly becoming more popular.

For canning purposes, the Boston or Autumnal Marrow and the Golden Delicious are most widely grown. Some varieties not widely grown in the West include the American Turban, Essex Hybrid, Victor, and Warren. Varieties of stock squash are not discussed here because they are not included in the group of table varieties.

Varieties of pumpkins. In the group of varieties of summer pumpkins (erroneously called summer squash) we find such varieties as the Yellow Summer Crookneck as well as the more recent introduction, the Yellow Straightneck; also the White and Yellow Bush Scallop and the White Vegetable Marrow. Of the fall varieties there are Table Queen, Delicata, Connecticut Field, Sugar Pie, and Winter Luxury. The latter is very useful as a fine quality table pumpkin as well as being a good variety for storage.

In the C. moschata group there are important varieties such as the Large Cheese, the Striped Cushaw, and the Tennessee Sweet Potato.

Soils for squash and pumpkins. Rich warm soils are best for these vegetables inasmuch as both crops prefer warm, well-drained soil of a sandy or silt loam type. The soil should be retentive of moisture as far as possible or should be irrigated as the vines are heavy in the summer and wilt badly unless the moisture is sufficient for the needs of the plant. Heavy land is unsuitable, often causing a poor stand of plants and inducing attacks of maggots. Very light soils are undesirable also, because they lose their moisture too readily. There seems to be no doubt but what larger yields in tons are obtained on the rich, warm, sandy loam soils as opposed to other types. There seems to be a direct correlation of the vigor of the vines of the plants with the number and size of squash produced; that is, provided there is a satisfactory setting of fruit.

Fertilizers. Well rotted manure is used for squash and pumpkins either broadcasted by hand or applied with a spreader or used in many cases by applying a fork-full of well rotted material to the hill. If manure is not available, commercial fertilizer may be applied, using a balanced complete fertilizer having a possible ratio of 1-3-2 which would be represented by a 4-12-8 fertilizer, or one might use a 4-12-6 or 4-10-6. If the number of hills per acre totals approximately 680, which would be by the planting of 8 feet by 8 feet, one would use approximately 300 to 400 pounds of this fertilizer per acre. A good handful applied to the soil of the hill at the time of seeding and thoroughly mixing this fertilizer with the soil would make it available for the plants in their early growth. The nitrogen and phosphorus in this fertilizer would tend to give the plants a good start. If the field has been cross-checked so that one knows where the seed is to be planted later on, it is advisable to apply the fertilizer during a period when there is a rainfall in order that the fertilizer may become dissolved and made available for the use of the young plants started in May.

Seed. Varieties of squash vary in the size and weight of seed. If one is buying 1 ounce of seed, therefore, the number of seeds contained therein will vary according to the variety as follows: Boston Marrow, 150 seed per ounce; Marblehead, 75; Delicious, 150; Golden Delicious, 125; Banana, 100 to 110. Of the vining pumpkin the number of seed per ounce is approximately as follows: Connecticut Field, 200; Winter Luxury, 300; Table Queen, 325 to 350. The amount of seed to be planted per acre, therefore, will vary from 1 to 2 $\frac{1}{2}$ or 3 pounds per acre. For seed that weighs approximately 150 per ounce, 2 pounds of seed would be required per acre, planting at the usual distances of 8 feet each way. This would provide for from 6 to 7 seeds per hill. One pound of pumpkin seed would provide enough for 7 seeds per hill, planting at the above named distances. A liberal seeding is advisable in order that one may have a good stand of plants in each hill. Squash seed is usually dropped by hand in hills 8 to 10 feet apart each way. It is desirable to sow the seed in a hill of rather wide diameter rather than to crowd the plants into a small hill. Another method of sowing the seed is to sow it with a drill, dropping seed every 18 to 24 inches and thinning later so the plants stand about 3 feet apart in the row. There is more room for each plant by this method but the plants can be cultivated only one way.

In view of the fact that squash seed in germinating may be subject to rot through wet spring weather and may also be affected by maggots, it may be desirable to treat the seed before planting with an organic mercury compound dust such as Semesan. A small and inexpensive amount of Semesan would be required for dusting enough seed for one acre.

The bush pumpkins are usually planted in hills 4 x 4 or 4 x 5 feet apart, or sometimes in rows with the plants standing 2 feet or so between each other in the

row. About twice as much seed would be needed for these bush varieties as for the vining pumpkins such as Table Queen or Winter Luxury.

Planting of squash and pumpkin seed is usually done during early May so that the plants may be above ground at a time when spring frost has ceased.

Control of early insects. In some seasons when the springs are wet and the soil unusually moist, squash seeds are subject to attacks by yellow maggots, which are the larvae of the twelve-spotted diabrotica beetle. These maggots are not so prevalent during a favorable spring season. They were particularly injurious in 1932 due to the wet weather of April and early May. Treating the seed with Semesan as previously stated will assist in keeping the seed from infection. As soon as the young squash plants are above ground, they are subject to attacks of the twelve-spotted beetle itself, eating the leaves, and it may be necessary to dust the leaves of the squash and pumpkin plants with an All-in-One garden dust or with a nicotine-sulfate dust. After the plants have once become well established, the beetles will no longer do damage. Thinning of the plants in the hills should not be done until it is observed that there is a full stand of plants in the hill.

Blossoming and fruit setting. Flowers of squash and pumpkin are individually male and female, borne independently on the plant. The staminate or male flowers have long, slender peduncles and are considerably more numerous than the pistillate or female flowers, which are borne on short, thick peduncles and have the small embryo squash at the base of the flower. In varieties of winter squash, such as Hubbard, the ratio of pistillate to staminate flowers is one to four or five. The flowering period of these plants extends over several weeks. The early setting fruit is usually the best, making the heaviest weight. Tapley found a positive correlation between the weight of the mature fruit and the date at which the fruit set. In large fruited varieties, the average weight per fruit decreased at the rate of one pound per day as the season of blossoming advanced. The later set fruit does not mature well or weigh nearly as much as the early setting fruit. Many of the blossoms, both male and female, abort or drop off, particularly a large number of the male blossoms. The flowers are open only about 24 hours and the pollen is transferred from the male to the female flowers by honey bees. A hive of bees is, therefore, useful in areas of squash and pumpkins.

It is important, therefore, to induce an early growth of the squash plants with an ample amount of foliage, for apparently the yield of the plants depends on the ability of them to produce a large number of blossoms, to produce these early and to have a large percentage of them fertilized.

Thinning plants. When the plants of the hills are established they may be thinned to two or three per hill, the best plants being left. Sometimes it is advisable to make two thinnings in the case of loss of plants from one cause or another.

Cultivation. Squash and pumpkin plants have an extensive root system, often 10 to 15 feet or more in diameter. The greater portion of the wide root system is in the first surface foot of soil, although there are some ramifications in the second foot. Care should be taken, therefore, that cultivation is not deep so as to interfere with the root development of the plants. If there are no weeds to be controlled by cultivation and no rains, there is no need for frequent cultivation during the summer. Early cultivations should be made to control weeds and to keep the soil in desirable tilth following rains.

Irrigation. Squash and pumpkin plants have a large leaf area besides an extensive root system and therefore draw heavily upon the soil moisture. In hot,

dry weather the plants wilt badly, thus decreasing the growth of the plant and the size of the fruit. If water is available for irrigation it will be valuable in stimulating an increased yield. The water should be run by gravity down one side of the rows or hills of plants. When the vines begin to reach between the rows the furrows should be left open so that later irrigations will permit the water to run down the furrows previously made. In some unusual cases the crop is watered by overhead sprinkling. Watering should be withheld at the end of the late summer in order that the fruit may properly mature during the fall months.

Insect control. There are two main insects affecting squash and pumpkins, namely, squash bugs and black aphid. Both of these insects are rather difficult of control, the aphid because they are in large numbers on the under sides of the leaves and difficult of access, and the squash bugs because they are also numerous and are both hard to trap or to kill. In the control of the black aphid, the under sides of the leaves must be covered with a nicotine spray or dust. If a dust is used, the temperature should be 70 degrees F. or above. The squash bug lives over winter in trash and attacks the young plants as soon as they come up. This insect punctures the tissues of the leaves and sucks the juices of them, causing them to wilt. The eggs are laid in large numbers on the under sides of the leaves and the young nymphs are soft-bodied and are more easily killed with contact sprays, such as a fish oil black solution.

The twelve-spotted beetles feed on squash and pumpkin plants when they are young, but do little damage to the plants after they are once well established, although they sometimes damage the blossoms.

Harvesting and storage. Bush pumpkins are harvested when the fruits are of a desirable size and when the skin is yet soft and easily penetrated by the nail. The vining pumpkins and squash are allowed to stay in the field to mature as long as possible before frosts occur. The fruit should not be frosted, although sometimes the vines may receive a slight frosting without any injury to the fruit itself. When ready to be harvested, the fruit should be cut from the vine with the stem attached. In all handling of the fruit, care should be taken to prevent bruising, abrasions, or injury to the skin. These are the first causes of decay occurring through careless handling. Sometimes squash are roughly treated because of having tough and hard rinds, but rots in storage invariably occur through skin abrasions and bruises. Following the cutting from the vine, the squash and pumpkins may be grouped but not piled in the field and if necessary covered with the vines to prevent being frosted.

In the removal to the storage place the greatest care should be used to prevent bruising. Wagons padded with straw or burlap will help prevent injury. The fruit should be stored preferably on racks or shelves one deep. They should not be piled. Fifty to sixty degrees temperature is best, although there is less loss of weight if a temperature of 42 to 52 degrees is maintained. Experiments have shown that the shrinkage and loss of squash kept in a room 50 to 60 degrees was 20.3% shrinkage and 4.8% decay over a period of four months. If the squash are not bruised and do not rot in storage, it is probable that there will be increased shrinkage as the temperature is raised above 50 degrees F.

Some varieties seem to keep better than others. The Table Queen pumpkin, for example, seems to lose its green color and take on a yellowish cast in early December and will not hold up so long in storage as some other varieties such as the Banana or Marblehead squash.

From time to time we have received inquiries concerning the kiln drying of squash. In brief, the methods which have been followed for this purpose have been

to place the squash on racks as they came from the field and to heat the temperature in the room to about 125° F. for a period of one week. The temperature was allowed to drop to a normal room temperature and the process again repeated after three or four days. This process was continued for some time, depending upon the amount of exudation of wax which forms on the outside of the squash. The purpose of this heating was to remove about 12% of the total moisture content of the squash, mainly of that portion near the shell. This treatment is also stated to effect a change of the acid content of the squash to sugar. Squash which is kiln dried will keep on the racks for quite a long time, possibly for 10 or 12 months after harvesting.

If the squash can not be kiln dried, it is desirable, if possible, to have a storage place that is reasonably dry in order that during the early stages of storage the skin of the fruit may dry out to some extent.

Yields and values. Yields of squash and pumpkin depend largely upon the soil in which the crop is grown. As has been pointed out, extensive foliage and root systems are correlated with large yields. Six tons per acre is an average yield on land of moderate fertility, up to ten tons on better land and even up to twenty tons on rich alluvial soil. From 8 to 12 tons is probably close to the average tonnage.

The values of squash vary from \$6 to \$8 per ton for cannery squash up to $\frac{3}{4}$ of a cent to 1 cent for market squash. At the present time of writing, namely, December 21, Danish squash, which is in reality the Table Queen pumpkin, is quoted at 65 to 75 cents per hundredweight, Hubbard at 1 cent to $1\frac{1}{2}$ cents per pound and Marblehead 1 cent to $1\frac{1}{4}$ cents per pound. Later on in the spring, stored or kiln dried Marblehead squash sells at $2\frac{1}{2}$ cents a pound.

Miscellaneous items. Squash varies in its composition, depending largely on the type and character of the fruit. As between so-called excellent and poor squash there may be a difference of from 6 to 10 per cent of moisture, with possibly a difference also of from 8 to 10% of dry matter. For instance, "excellent" squash of the Hubbard variety will have approximately 80 to 83% moisture and 16 to 20% dry matter. Of the dry matter, from 11 to 12% is protein. Mature squash will also have a lesser percentage of moisture than immature squash.

In determinations made to ascertain the correlation of the hardness of the shell of the squash with the percentage of soluble solids, it has been shown that there is a definite correlation between the hardness of the shell and the increased amount of soluble solids.

In other words, there is rather a definite tendency for the percentage of total solids to increase as the hardness of the shell increases. Varieties also vary in their content of water and soluble solids. Boston Marrow, for example, being found to be a variety having a higher water content than Golden Delicious. As a consequence, the per cent of total soluble solids was considerably lower in the former.

There is a great variation, however, in individual specimens of the same variety in the field insofar as total water content and total soluble solids are concerned. In fact, it is this wide variation of maturity and characters of specimens in variety which makes it difficult for the canner to obtain a product which has a uniform consistency. This is also brought about by the period of time over which blossoms produce fruit and the fruits set, thereby causing differences in the length of time different fruits have grown and the time it takes them to reach proper maturity.

In a study of the sugar development in relation to the maturity of the Table Queen pumpkin, it has been shown that the starch and sugar content increased gradually from the first week after the fruit had set up to the first nine weeks, at which time the starch and sugar has reached its highest point.

During the same period, the moisture content decreased from 94% of the first week to 75% in the eighth week of growth.

For circulars dealing with many other vegetable crops such as asparagus, rhubarb, cabbage, cauliflower, broccoli, celery, lettuce, onions, peas, tomatoes, spinach, etc., address the writer of this circular or the Clerical Exchange, Corvallis, Oregon.