**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY**
WASHINGTON, D.C. 20460

OFFICE OF CHEMICAL SAFETY
AND POLLUTION PREVENTION

**MEMORANDUM**

**SUBJECT:** **Acres Planted per Day and Seeding Rates of Crops Grown in the United States**

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## SUMMARY

This memo provides information on the seeding rates and acres planted per day for most crops grown from seed in the United States, in addition to basic information about the planting practices used in the production of these crops. These data will be used by the Health Effects Division (HED) as input values to calculate worker exposure and risk from handling treated seed and by the Environmental Fate and Effects Division (EFED) as input values to calculate terrestrial residues from treated seed.

## BACKGROUND

This document responds to three information requests from the Health Effects Division (HED) and one information request from the Environmental Fate and Effects Division (EFED). HED first requested data on seeding rates and acres planted per day on four agronomic crops (corn, soybean, rice, and wheat). Later, the request was broadened to include data for cotton and then broadened again to include almost all crops, grown from seed that are produced in the United States. These data, along with results from a survey now being conducted by Agricultural Handlers Exposure Task Force (AHETF) on seed treatments, will be used to revise HED's Science Advisory Council for Exposure, Standard Operating Procedure Number 15, entitled *Amount of Seed Treated or Planted per Day* (Tadayon and Dole, 2004). EFED requested data on seeding rates for 45 crops to update some of the default values used in the Terrestrial Residue EXposure model (T-REX) (USEPA, 2008). Seed counts per pound are given in Appendix B.

Historically, seeding rates were expressed in some measure of volume per acre (e.g., bushels per acre) or in weight per acre (e.g., pounds per acre). This is still a common method for some crops, especially small grains and forage crops. However, with the advent of precision planters, changes in how seeds are modified prior to planting (pelleting), and a better understanding of how seeding and plant density affects yield, the recommended seeding rates for many crops are now expressed in units of number of seeds per acre. Two examples illustrating these reasons follow.

Many vegetable seeds are pelletized. In this process, layers of polymers and clays containing nutrients, plant protectants, and/or inoculums are added around each seed. This process results in a smooth rounded shape that is easier to plant using precision planters and changes the micro-environment of the seed as it germinates. The pelletizing process increases both the volume and the weight of each individual seed. Since these increases are not directly proportional to that for raw seed (i.e., volume = $4/3\ \pi\ r^3$, where r = radius, and weight = volume * density), seeding rates of pelletized seeds are always expressed in the number of seeds per unit area (e.g., seeds per acre) or number of seeds per linear foot of row for a given row width (e.g., three seeds per foot of row with rows 11" apart).

Seeding rates, expressed in pounds per acre, are also a poor measure for crops with highly variable seed size and shape. For example, consider dry beans that, regardless of variety, are planted at a rate of four to six seeds per foot of row, usually in 30-inch rows. This would result in a range of 69,696 (four seeds per row foot) to 104,544 (six seeds per row foot) seeds per acre. Kidney beans average 758 seeds per pound and black beans average 2,268 seeds per pound. Assuming that seeds were placed 2 inches apart (six seeds per row foot), it would require 138 pounds of kidney beans or 46 pounds of black beans to plant an acre using 30 inch rows (ANR, 2010).

## METHODS

Seeding rates and production information

The Census of Agriculture (NASS, 2007) was used to identify States with the highest production of the crops. When available, specific seeding recommendations for each crop were located for these states, primarily from state extension service recommendations and crop production guides. In the case of field corn and rice, when the optimal plant density at harvest were found, these values were converted into seeding rates by adjusting for typical percent germination and stand loss (Table 4).

The number of seeds per acre was calculated from the recommended row width and in-row spacing, using the following equation:

$$\frac{Seeds}{Acre} = \frac{43{,}560\ sq.\ feet}{Acre} \bullet \frac{144\ sq.\ inches}{1\ sq.\ feet} \bullet \frac{Seeds}{inch\ (in-row)} \bullet \frac{1}{inch\ (row\ width)}$$

Appendix A (Table A-1) provides the results of these calculations for various row widths and in-row spacing.

Acres planted per day

Crop enterprise budgets were consulted to identify planter type and size as well as planting rates (acres per hour) for cotton. Acres planted per day were estimated using an economic model for field corn and soybeans. For other agronomic crops, the acres planted per day were estimated using planter performance data from a study on machinery cost estimates (Lazarus, 2009). For horticultural crops, the acres planted per day were estimated using best professional judgment based on knowledge of production practices for a particular crop and personal communications with crop advisors.

References consulted

Multiple references were consulted for each crop in an attempt to collect a relatively complete description of the seeding rates and cultural practices across the primary production areas. References are arranged alphabetically within topic. All reference accessed from the internet were available as of August 2010.

Uncertainties

- Growers often vary the recommended seeding rate based on their previous experience with the crop and variety, knowledge of the historical productivity of a given field, weather, planting date, and existing soil conditions. These adjustments are in addition to the factors affecting the number of acres planted per day described below.
- Number of seeds per pound is variable. Depending on the variety being produced, seeding rates vary.
- Seeding rates were calculated based on the product of the minimum reported row width and the minimum reported in-row spacing. This should be considered a high-end value as growers are likely to establish less densely planted crop stands.
- End use / harvest method – Many crops have multiple end uses and may be harvested several ways. The listed end use / harvest method may not include all possible end use and harvest methods employed for a particular crop.
- Propagation material – Many crops are commercially produced either from seed or from transplants, depending on grower preference and local conditions.

Limitations

- BEAD's survey of published seeding rates and production practices may not have captured the complete range of seeding rates in all of the production regions for a given crops.
- This document does not include data on the production of transplants in greenhouses. In a few cases where information was available, production of transplants from seed in seedbeds is included.

**PLANTERS**

Functions of a Planter

Crop establishment is one of the most important activities in crop production. By establishing the crop in a timely and uniform manner at the optimal plant density, growers achieve increased crop yields, reliability, cropping frequency and higher economic returns (Murray et al., 2006). Planters are the key component for efficient crop establishment. Planters reliably perform a sequence of tasks at an acceptable speed. Murray et al. (2006) identified these tasks as follows:

- Open a furrow (including cutting residue, row preparation, and furrow opening),
- Meter the seed,

- Deliver the seed and place it appropriately in the furrow,
- Firm and cover the seed in the furrow,
- Firm and level the seedbed, and
- Perform other functions as required (e.g., apply herbicides or other agricultural chemicals).

Classification of Planters

Murray et al. (2006) classify planters by type, the number of rows planted, and the power source (method of attachment to and type of power source). Power sources can be human, animal, or tractor. Human powered planters can be pushed or pulled through the field or they may be hand-held. Types of planters include broadcast, drill, precision, or specialized.

Broadcast planters randomly distribute seeds on the soil surface and a separate operation is required to cover the seed (e.g., harrowing). Broadcast planters are often used to establish crops that have very small seeds (e.g., alfalfa) or those that require light to germinate (e.g., some pasture grasses).

Drill planters randomly drop seed into closely spaced furrows. This type of planters uses mass flow seed metering and is used to establish crops where there is little incentive to place seeds equidistant in the row. Almost all small cereal grains (e.g., oats, barley, wheat) are planted using drill planters.

Precision planters are used to accurately place single seeds or groups of seeds equidistant in the row. This type of planter can use one of several types of precision metering devices (e.g., belts, plates) and is used to plant crops that require accurate control of the plant population. Crops planted with this type of planter include almost all horticultural crops (e.g., vegetables) and field crops (e.g., sorghum, corn, soybean, sunflower, and cotton).

Specialized planters are considered here to be those that plant whole plants (e.g., seedlings or transplants), plant stems (e.g., sugar cane) or tubers and bulbs (e.g., potatoes and onions).

Components of a Planter

Planters are composed of a series of components, each of which performs a particular function. Murray et al. (2006) group these into four categories – soil-engaging components, furrow opener depth control components, seed metering components, and seed delivery components. A short description of these categories follows, based on Murray et al. (2006).

Soil-engaging components cut through the soil and crop residue (e.g., disc coulters), prepare the row (e.g., blades, finger wheels), open a furrow (e.g., discs, tines, knives), firm and cover the seed (e.g., firming wheels; chains, disc coulter, finger wheel), and firm and level the seedbed (e.g., press wheels, coil press; rollers, packers, harrows).

The depth of the furrow is controlled by the use of adjustable depth wheels attached to the planter.

Planters use a variety of seed metering devices. Two broad categories can be defined – precision metering devices and mass flow metering devices. Precision meters attempt to separate and deliver a single seed per unit time. As long as the speed of the planter is maintained, a pattern of equally spaced seeds will result. In general, precision metering devices are used on planters that are used for crops that are produced from expensive seed, have a low planting density, are planted in relatively wide rows, have a specific plant population from which optimal yields result, and show a positive yield response to even plant spacing. Crops that are planted with this type of metering device include most horticultural crops, corn, sorghum, sunflowers, and beans. These planters are often called “row crop” planters.

The other type of seed metering device is referred to as mass flow. Here, the metering devices do not separate individual seeds but rather attempt to meter a consistent volume per unit time. Usually these types of devices are used for crops that have a high planting density, are planted in relatively narrow rows, and can tolerate variable seeding rates and uniformity of seed spacing without a significant loss in yield. Crops that are planted with this type of metering device include small grains and grasses. These planters are often called “broadcast”, “drills”, or “air seeders.

Seed delivery components are usually only important on precision planters, where they affect the uniformity of seed placement. In these systems, the seed delivery system is small short straight tubes with a smooth interior. The tube deflects the seed toward the rear of the planter so that the seed leaves the tube with a rearward velocity equal to the forward velocity of the planter.

All components of the planter must function together to accurately place undamaged seed in ground. Further, each component of the planter has an impact on the overall speed of the planter and impacts the number of acres that can be planted in a day. Table 1 lists the most common types of seeders or planters and the crops that are typically planted using them.

**Table 1. Some Common Types of Seeders / Planters and Typically Planted Crops.**

| General | Type of Seeder / Planter | Example Brand Names | Typical Crops Using Planter |
|---|---|---|---|
| **Agronomic** | | | |
| Mass flow | Aircraft spreaders | Simplex<br>Transland | Rice (Water seeded) |
| | Ground broadcast / spreaders | Great Plains Mfg.<br>Truax | Small grains |
| | Drills /Air Drills | Deere and Co.<br>Case IH<br>Seed Hawk | Small grains<br>Forage crops |
| Precision | Cup planter | Dobmac<br>Spudnik<br>Kvernelands | Potato<br>Garlic<br>Onion |
| | Row planter | Deere and Co.<br>Case IH<br>New Holland | Field corn<br>Soybean<br>Cotton |
| **Horticulture** | | | |
| Mass flow | Row planter | Planet Jr. | Some vegetables with poor germination rates (later thinned to optimal stand) |
| Precision | Belt Seeder | Stanhay | Most vegetables produced from seed |
| | Plate planter | Deere 33 | |
| | Sponge rotor / plate | SeedSpider | |
| | Seed wheel planter | Gramor, Webb | |
| | Cup disk planter | Nibex | |
| | Vacuum seeders | Stanhay, Berlin Namete, Health Universal Planter, Monosem, Pneumasem II | |
| **Specialty** | | | |
| Precision | Transplanter | R.A. Whitfield<br>Holland | Tomato (Fresh market) |
| | Spriggers | Bermuda King | Bermudagrass |
| | Forest Service Planters | Custom (Forest Service plans) | Forest seedlings |
| **Transplant Production** | | | |
| Precision | Vacuum template<br>Vacuum tips or needles<br>Vacuum cylinder or drum<br>Electric eye | Evergreen<br>Gro Mor<br>Many custom built seeders | Greenhouse production of transplants |

Primary Sources: Case IH (2010); Daum and Orzolek (2001); Forest Service, USDA (undated); Great Plains Mfg., Inc. (2010); Murray et al. (2006); Deere and Co. (2010); Monosem (2005-09); Sanders (1997); Seed Hawk (undated); Seed Spider Seeding Systems (undated); Spudnik (2006); Sutton Ag. Enterprises (undated); Wiedemann (2007a, b). The use of brand names does not reflect endorsement by the US EPA. Some of the example brands are no longer manufactured.

**ACRES PLANTED PER DAY**

Factors affecting the Number of Acres Planted per Day

To correctly assess and characterize the number of acres planted per day for a given crop, the following types of information should be considered:

- Method of propagation of crop. Crops are propagated in several ways, including direct seeding, transplants (originally produced from seeds), and plant pieces. Some crops may propagated from all of these methods (e.g., asparagus) while other crops are exclusively produced using only one method (e.g., mint – all from plant pieces; wheat – all direct seeded). Each method used places an upper bound on the number of acres that can be planted in a day.
- Soil and climatic condition. Local conditions also places constraints on the potential acres planted in a day. For example, heavy wet soils necessitate a reduced operating speed. When optimal weather and soil conditions for planting occur for a crop that has a narrow planting window, growers will often plant for 12 or more hours a day.
- Cultural practices. Growers of a particular crop may use several different cultural practices to produce that crop. For example, no-till fields are planted at a slower speed because of the crop residue remaining on the surface.
- Optimal plant density. Each crop has an optimal plant density at harvest that will produce maximum yield and quality. This depends on local growing conditions (soil and weather conditions), crop variety, and cultural practices. In trying to achieve this optimal density, growers may adjust planting activities, affecting acres planted per day.
- Pre-plant treatment of seed. In addition to the application of pesticides, seeds may be pre-conditioned to improve seed germination and plant establishment and remove mechanical and environmental constraints. These treatments may include hydration, seed scarification, pelleting, and inoculation. The resulting seed may be fragile and require special handling and the slower planter settings that will limit the number of acres planted in a day. Many irregularly shaped seeds are pelletized so that they can be more easily singulated.
- Seeding rate. For many crops the seeding rates are higher than the optimal plant density to account for the percent germination and stand loss prior to harvest. However, some crops are planted at a density equal to the stand at harvest, while for other crops the seeding rate can be variable without influencing yield. In some situations, growers plant at a higher density to improve weed control.
- End use of commodity. The intended use of the commodity can affect the number of acres planted for some crops. Some crops have a narrow planting window (e.g., corn) and growers will maximize the number of acres planted when conditions are optimal. In other crops (e.g., lettuce and fresh market tomatoes), staggered plantings are used to match harvest requirements, so the maximum acres per day, based on the engineering performance of the planter, is never achieved.
- Planting equipment and planting method used. The type and size of the planter and the associated equipment have a significant impact on the number of acres planted per day, as does the planting method. For example, rice may be seeded using several types of drills, each with an optimal rate of performance. Rice can also be planted using aerial seeding. In this example the method of planting is the primary determinate of the number of acres planted per day. Other crops, such as corn, may be produced in conservation tillage systems using planters that require additional equipment to deal with the crop residue in the field.
- Hours worked per day. Depending on the length of the planting window and local conditions, the number of hours worked per day can be more than a default eight-hour day because of the importance of timely crop establishment, even when considering non-planting activities (breaks, moving equipment between fields, etc.) .
- Market window. For some short season crops (e.g., lettuce) or vegetable crops that are produced under delivery contracts (e.g., fresh market tomatoes) that cannot be held for long periods in storage, the standard practice is to use staggered or sequential plantings. This allows the grower to fulfill delivery contracts on time. Additionally, growers can mitigate the risk of price fluctuations by producing throughout the harvest window. For these crops the amount harvested per day controls the amount planted per day rather than the capacity of the planting equipment.

- Field Size and Shape. The dimensions of the field influence planting speed and the number of acres planted per day, primarily through the number of turns that the planter must make. Distance between grower's fields will also impact the number of acres planted per day.
- Row Width and Pattern. The number of acres planted per day depends on the row width and pattern of rows planted. For example, cotton may be produced using ultra-narrow rows (10 to 15-inch), narrow rows (30-inch), or 40-inch rows. Additionally, cotton may be planted in a 2 x 1 skip row pattern (2 planted rows, one blank row).

Many of these factors are interrelated and cannot be considered in isolation. Table 2 lists some types of planting equipment and the number of acres that can be planted per day according to Lazarus (2009).

**Table 2. Planting Equipment and Acres Planted per Day.**

| Planting Equipment Description | Acres planted per hour | Acres planted (8-hr day) | Acres planted (12-hr day) |
|---|---|---|---|
| John Deere DB120, 48 row, 30" row spacing, 120 Ft | 100 | 800 | 1200 |
| Row Crop Planter, 6 Row, 30" row spacing, 15 Ft | 7.00 | 56 | 84 |
| Row Crop Planter, 8 Row, 30" row spacing, 20 Ft | 9.33 | 75 | 112 |
| Row Crop Planter, 12 Row, 30" row spacing, 30 Ft | 14.00 | 112 | 168 |
| Row Crop Planter, 16 Row, 30" row spacing, 40 Ft | 18.67 | 149 | 224 |
| Min-Till Planter, 6 Row, 30" row spacing, 15 Ft | 6.36 | 51 | 76 |
| Min-Till Planter, 8 Row, 30" row spacing, 20 Ft | 8.48 | 68 | 102 |
| Min-Till Planter, 12 Row, 30" row spacing, 30 Ft | 12.73 | 102 | 153 |
| Min-Till Planter, 16 Row, 30" row spacing, 40 Ft | 16.97 | 136 | 204 |
| Potato Planter, 4 Row, 12.6 Ft | 3.83 | 31 | 46 |
| Potato Planter, 6 Row, 19 Ft | 5.75 | 46 | 69 |
| Potato Planter, 8 Row, 25.3 Ft | 7.67 | 61 | 92 |
| Beet Planter, 12 Row, 22 Ft | 4.67 | 37 | 56 |
| Beet Planter, Vacuum 24 Row, 44 Ft | 22.40 | 179 | 269 |
| Presswheel Drill, 16 Ft | 6.79 | 54 | 81 |
| Presswheel Drill, 20 Ft | 8.48 | 68 | 102 |
| Presswheel Drill, 25 Ft | 10.61 | 85 | 127 |
| Presswheel Drill, 30 Ft | 12.73 | 102 | 153 |
| Air Seeder Drill w/Cart, 52 Ft | 22.06 | 176 | 265 |
| No-Till Drill, 15 Ft | 6.36 | 51 | 76 |
| No-Till Drill, 20 Ft | 8.48 | 68 | 102 |
| No-Till Drill, 30 Ft | 12.73 | 102 | 153 |
| Prairie Grass Drill, 10 Ft | 5.15 | 41 | 62 |
| Prairie Grass Drill (Twinned) , 21 Ft | 10.82 | 87 | 130 |

Sources: Southwest Farm Press (2009); Lazarus (2009). Values in this table are as reported in these original sources.

Soybean and Field Corn

Field corn and soybeans are the largest crops in terms of acreage grown in the United States. The number of acres planted per day is variable and depends on planter characteristics (number of rows, row spacing), operating speed of the planter, and number of hours worked per day. These factors are in turn influenced by farm size (field size), soil characteristics, weather, and planting date.

*Row Width* – The NASS (2007) review of corn yield surveys focused on seven major corn producing states (Illinois, Indiana, Iowa, Minnesota, Nebraska, Ohio, and Wisconsin). In 2006 these seven states accounted for 75 percent of all corn for grain production. The NASS report examined changes over a 15-year period of number of plants per acre and average row width. In 2006 the average number of plants per acre across these seven states was 27,421, an increase of 18 percent from that in 1992. Over this same time period, row space measurements have decreased significantly. The average row width was 30.5 inches in 2006, a decrease of 6 percent from that in 1992.

*Hours per day*—Corn growers try to plant their entire corn crop within a fairly narrow window of time that will potentially produce the optimal yield for their crop. For example, in Illinois, the optimal planting date is around April 27. Corn planted on May 5th would produce 1 bushel per acre less, 9 bushel less on May 15th, and 34 bushels less on May 31st. Because weather can further limit the available planting days within this optimal window, growers will usually work more than an eight hour day to ensure that as much of their crop as possible is planted close to the optimal date. Further, the grower may accommodate for less than optimal equipment for a given farm size by working more than eight hours. For example, the University of Illinois analysis (Schnitkney, 2004) assumed that planters were used 12 hours per day to calculate the optimal planter costs for different sized farms.

*Planters* – BEAD does not have survey data on the distribution of the size and style of corn and soybean planters currently being used in the United States. However, Schnitkney (2004) examined the relationship between planter size (number of rows) and farm size. The acres that each planter could plant are estimated using an University of Illinois model (FAST, 2007) that includes inputs for row width, number of rows on the planter, speed, and field efficiency. Field efficiency accounts for the turning of the planter at the end of rows, planting end rows, filling the planter, and stopping the planter for maintenance or some other reason. The acres that each planter could plant per hour (Table 3) were determined using the model default values of six miles per hour and a field efficiency of 70 percent.

**Table 3. Planter Size, Acres Planted per Hour, and Acres Planted per Day.**

| Planter Size | Acres Planted Per Hour | Acres planted in 8 hours* | Acres planted in 12 hours |
|---|---|---|---|
| 6-row | 7.6 | 61 | 91 |
| 8-row | 10.2 | 82 | 122 |
| 12-row | 15.3 | 122 | 184 |
| 16-row | 20.4 | 163 | 245 |
| 24-row | 30.5 | 244 | 366 |
| 32-row | 40.7 | 326 | 488 |
| 36-row | 45.8 | 366 | 550 |

* Acres planted per hour based on FAST (2007).

Cotton

Enterprise budgets for cotton (Hutmacher, 2003a-c; Paxton, 2010; Shurley and Smith, 2010; and TAMU, 2008) report about 8.5 acres per hour can be planted, or 68 A (8-hr day) to 102 A (12-hr day) per day. These studies included 6- to 12-row planters.

Rice

Rice can be drill seeded using ground equipment, or water-seeded using aircraft. Enterprise budgets for rice (Watkins et al., 2009) report that 10.5 acres per hour can be planted using a 20-foot grain drill, or 84 A (8-hr day) to 126 A (12-hr day) per day. The USA Rice Federation (S. Hensley, pers. comm. to J. Becker, 19 Aug 2010) reports a range of 550 to 1000 A planted by aircraft per day, dependent on weather conditions and type of equipment used.

Wheat and Other Drill Seeded Crops

Small cereal grains and forage crops are usually drill seeded or broadcast. Acres planted in a day are strongly dependent on the type of planter used. Lazarus (2009) reports the number of acres planted per hour for a variety of planting equipment. About 5 to 22 acres can be planted per hour for drill seeded crops, or about 40 – 176 A (8-hr day) to 60 – 264 A (12-hr day) per day. The number of acres planted per day using broadcast equipment is substantially greater because of the greater swath width and planting speed.

Other Crops

Vegetables grown for the fresh market are usually produced on small fields from transplants or from pelleted seeds. Planting often includes forming a raised bed, precision planting multiple rows on the bed, and laying drip tape(s). Plastic mulch may be used. Many crops are planted at staggered intervals, so that a constant supply can be harvested throughout the season. Because many of these planting activities are time consuming, they limit the number of acres planted per day. BEAD did not attempt to estimate the number of acres planted per day for these crops. Should HED or EFED need more information on the planting rates, BEAD will investigate on a case-by-case basis.

Potatoes can be planted at a rate of 4.5 to 5.5 acres per hour using a six-row potato planter (Spudnik, 2010). This would translate to a rate of 36 to 44 acres per day (8-hr day) or 54 to 66 acres per day (12-hour day).

**SEEDING RATES**

As with the number of acres planted per day, many of the same considerations listed above apply here.

Field Corn

Table 4 lists the field corn seeding rates and the optimal number of plants per acre at harvest for the top producing states. According to these recommendations, growers should target a population of up to 35,000 plants per acre at harvest. In practice many growers target a lower population because of high seed costs and the increase risk of lodging at higher populations.

**Table 4. Field Corn Seeding Rates and Recommended Number of Plants at Harvest.**

| State | Seeding Rate (Seeds / A)* | Recommended Number of Plants per Acre at Harvest |
|---|---|---|
| Iowa | 35,200 to 36,800 | 32,000 |
| Illinois | 33,000 to 40,250 | 30,000 to 35,000 |
| Nebraska | 8,800 to 18,400 | 8,000 to 16,000 (dryland only) |
| Minnesota | 36,300 to 39,100 | 32,000 to 34,000 |
| Indiana / Ohio | 33,000 to 34,500 | 30,000 |
| South Dakota | 26,400 to 36,800 | 24,000 to 32,000 |
| Kansas | 24,200 to 27,600 | 22,000 to 24,000 |
| Wisconsin | 33,000 to 40,250 | 30,000 to 35,000 |
| Missouri | 26,400 to 34,500 | 24,000 to 30,000 |
| North Dakota | 26,400 to 36,800 | 24,000 to 32,000 |
| Michigan | 35,200 to 36,800 | 32,000 |

Notes: *Seeding rate is 10 to 15 % higher than the target number of plants at harvest. Primary Sources: Abendroth and Elmore (2007), Copeland et al. (undated), Coulter (2009), Degni and Woodsen (undated), Farnham (2001), Hoette (1997), Klein and Lyony (2003), Lamm et al. (2006), Nielsen (1995), Nielsen and Thomison (2002), North Dakota State University Agriculture and University Extension (1997), Ohio State University Extension (2009), Ransom et al. (2004), South Dakota State University (2009).

Soybean

The recommended seeding rate for soybeans has declined over the last several years. Table 5 lists the recommended soybean seeding rates for the top producing states as of 2006 and the rate that is currently being recommended.

**Table 5. Soybean Seeding Rates.**

| State | Maturity Groups | 2006 Seeding Rate Recommendation | Current Recommendation |
|---|---|---|---|
| Arkansas | V, VI | 60,000 to 240,000 seeds / A | In general, a final stand of 100,000 soybean plants per acre is recommended. To achieve this stand, a seeding rate of 125,000 - 140,000 seeds per acre is used. Some acres (estimated by Pederson at 10%) are drilled using a seeding rate of 175,000 - 200,000 seeds per acre. |
| Iowa | II | 60,000 to 225,000 seeds / A | |
| Illinois | II, III, IV | 50,000 to 200,000 sees / A | |
| Indiana | II, III, IV | 131,000 to 210,000 seeds / A | |
| Kansas | III, IV | 100,000 to 150,000 seeds / A | |
| Minnesota | 00, 0, I, II | 80,000 to 200,000 seeds / A | |
| Missouri | III, IV | 150,000 to160,000 seeds / A | |
| North Dakota | 00, 0 | 100,000 to 250,000 seeds / A | |
| Nebraska | II, III | 120,000 to 160,000 seeds / A | |
| Ohio | III | 125,000 to 225,000 seeds / A | |

Primary Sources: Arce et al. (2009), Ashlock et al. (2006), Bennett (undated), Beuerlein and Dorrance (undated), Butzen (2002), Davis (2010), De Bruin and Pedersen (2007), DeBruin and Pedersen (2008), Elmore and Specht (1999), Glewen et al (2010), Hanson (2004), Naeve (2008), Pedersen (undated), Pedersen (2008), Robinson and Conley (2007), Roozeboom (2009).

Pedersen (2008) enumerates some of the factors that soybean growers consider when determining their seeding rates, as follows:

- Seed bed condition (increase rates for less than optimal condition),
- Row spacing (increase rates as sow spacing decreases),
- White mold prevalence (decrease seeding rates and use tolerant varieties),
- Seed quality (increase rates if no fungicide is used),
- Seed germination (increase rates to adjust for low germination rates), and
- Planting speed (increase rates at higher speeds to adjust for poor seed placement).

Cotton

Cotton row spacing can be more diverse than that in most crops. Row spacing (width) may range from 15 to 40 inches. Every row may be planted (solid configuration) or every second row may be left unplanted (2x1 skip-row configuration). The plant canopy closes earlier in narrow row and solid plantings resulting in suppressed weed growth. Skip row configuration reduces the seeding rates per acres but results in less weed suppression and a later maturity date. Table 6 lists the seeding rates, row widths, planter size, and seeding rate per acre for cotton.

**Table 6. Cotton Seeding Rates, Row Widths, Planter Size, and Seeding Rate per Acre.**

| State, Variety | Row Width | Planter | Seeding Rate (Seeds / A) |
|---|---|---|---|
| CA, Acala | 30” | 8- or 10-row | 35,000 to 85,000 |
| CA, Acala | 40” | 6-row | 35,000 to 85,000 |
| CA, Pima | 38” to 40” | 6-row | 30,000 to 85,000 |
| LA | 30” to 36” | 8- or 12-row | 52,500 |
| TX | 30” | 12-row | 50,000 to 52,800 |
| GA | 36” | 8-row | 36,300 to 39,930 |

Sources: Hutmacher (2003a-c); Paxton (2010); Shurley and Smith (2010); and TAMU (2008).

Wheat

Table 7 lists the seeding rates by the state and type of wheat.

**Table 7. Seeding Rates by Type of Wheat.**

| State | Hard Red Winter | Hard Red Spring | Soft Red Winter | White | Durum |
|---|---|---|---|---|---|
| Kansas | 50-75 lb/acre (dryland)<br>75-90 lb/acre (irrigated)<br><br>600,000 to 900,000 seeds / A (Western KS, dryland)<br><br>750,000 to 900,000 seeds / A (Central KS, dryland)<br><br>900,000 - 1,125,000 seeds / A (Eastern KS, dryland)<br><br>900,000 to 1,350,000 seeds / A (irrigated) | | | | |
| North Dakota | 900,000 seeds / A (or about 70 lb / A) | 60 to 120 lb / A | | | 60 to 120 lb / A |
| Texas | 30 to 40 lb / A (dryland)<br>60 to 90 lb / A (irrigated) | | | | |
| Montana | 70 to 100 lb / A (dryland)<br>100 to 130 lb / A (irrigated) | 84 to 120 lb / A (dryland)<br>120 to 156 lb / A (irrigated) | | | 60 to 65 lb / A (dryland)<br>75 to 90 lb / A (irrigated) |
| Oklahoma | 60 lb / A | | 60 lb / A | | |
| South Dakota | 60 lb / A | 72 lb / A | | | |
| Washington | | | | 85 lb / A | |
| Colorado | 30 to 50 lb / A (dryland)<br>75 to 90 lb / A (irrigated) | | 30 to 50 lb / A (dryland)<br>75 to 90 lb / A (irrigated) | | |
| Minnesota | 75 lb / A | 60 to 120 lb / A | 75 lb / A | | 90 lb / A |
| Idaho | 70 to 100 lb / A (dryland)<br>100 to 130 lb / A (irrigated) | 84 to 120 lb / A (dryland)<br>120 to 156 lb / A (irrigated) | | | |
| Missouri | | | 100 to 120 lb / A | | |
| Illinois | | | 100 to 120 lb / A | | |
| Wisconsin | | | 1,300,000 to 1,500,000 seeds / A | | |

Primary Sources: Conley and Gaska (2007), Ellis (2006), NDSU (1998a, b), Oelke (2010), Peel et al. (1997), USDA (1999a, b, 2000, 2002, 2003), Wiersma (2002).
Blank cells indicate little or no production of a specific type of wheat in that state.

Rice

Table 8 lists the seeding rates for rice, accounting for different field conditions, planting methods, and types of rice. Local field conditions determine whether rice is water-seeded or drilled. Water-seeded rice typically occurs in southern Louisiana and California and is becoming more common in Arkansas and Missouri.

**Table 8. Conventional Rice Seeding Rates*.**

| Field Conditions and Agronomic Practices | Seeding Rate (Seeds / A)* | Seeding Rate (Lbs / A) | | |
|---|---|---|---|---|
| | | Short grain | Medium grain | Long grain |
| Drill seeded, good land preparation | 1,742,400 | 92 | 84 | 77 |
| Drill seeding, poor land preparation | 2,090,880 | 111 | 101 | 92 |
| Broadcast, good land preparation | 2,090,880 | 111 | 101 | 92 |
| Broadcasting, poor land preparation | 2,439,360 | 129 | 118 | 107 |
| Drill seeded, good land preparation and early planting | 1,916,640 | 101 | 93 | 84 |
| Water seeded condition | 2,265,120 | 120 | 110 | 100 |
| Clay soil condition | 2,090,880 | 111 | 101 | 92 |

Based on the number of seeds needed per sq ft to reach the optimum plant density of 15-20 plants per sq ft. density (seeds with 85% germination, bird damage, seed misplacement etc.). Sources: Beyrouty et al. (1997), OSU Extended Campus (undated), Runsick and Wilson (undated), Shipp (2002), University of California (2001), Way and Cockrell (2005).

* Hybrid rice varieties are planted at lower rates (up to 40 percent less than conventional varieties, Smith (2000)).

Forage Crops

Table 9 lists the approximate number of seeds per pound and seeding rates for forage crops. The rates listed are for a pure stand of the crop, but often mixtures of species are planted for forage. Sulc and Barker (2005) provide seeding rate information for a number of forage mixtures.

**Table 9. Forage Crop Seeding Rates.**

| Crop | Number of Seeds per pound | Pure Live Seed (PLS)* Seeding Rate (lbs per acre) |
|---|---|---|
| **Perennial Legumes** | | |
| Alfalfa | 227,000 | 15 |
| Alsike clover | 700,000 | 9 |
| Arrowleaf clover | 350,000 to 400,000 | 5-8 |
| Berseem clover | | 15-20 |
| Birdsfoot trefoil | 375,000 | 9 |
| Crimson clover | | 20-30 |
| Kura clover | 227,000 | 6 |
| Red clover | 275,000 | 11 |
| Rose clover | | 15-20 |
| White clover | 860,000 | 5 |
| Crownvetch | 140,000 | 9 |
| Annual Lespedeza (Striate and Korean) | 240,000 | 25-35 (broadcast) 15-20 (drilled) |
| Sericea Lespedeza | 350,000 | 20-30 |
| Teff | 1,200,000 to 1,300,000 | 8-10 |
| **Perennial Grasses and Forbs** | | |
| Festulolium | 227,000 | 25 |
| Kentucky bluegrass | 2,200,000 | 10 |
| Orchardgrass | 590,000 | 10 |
| Perennial ryegrass | 237,000 | 24 |
| Reed canarygrass | 550,000 | 10 |
| Smooth bromegrass | 137,000 | 16 |
| Common Bermudagrass | 2,071,000 | 2-8 |
| Red Fescue | 546,000 | 5 |
| Tall fescue | 227,000 | 15 |
| Timothy | 1,230,000 | 8 |
| Big bluestem | 150,000 | 12 |
| Eastern gamagrass | 7,400 | 9 |
| Indiangrass | 175,000 | 12 |
| Switchgrass | 370,000 | 9 |
| Chicory | 375,000 | 6 |
| **Annuals and Biennials** | | |
| Annual ryegrass | 228,000 | 24 |
| Hairy vetch | 28,000 | 25-60 |
| Kale | 140,000 | 4 |
| Pearl millet | 85,000 | 20 |
| Oats, spring | 15,000 | 87 |
| Rape | 145,000 | 4 |
| Rye, winter | 18,000 | 109 |
| Sorghum, forage | 28,000 | 12 |
| Sorghum-sudangrass | 28,000 | 23 |
| Sudangrass | 55,000 | 24 |
| Swede | 200,000 | 2 |
| Turnip | 190,000 | 2 |
| Triticale | 16,000 | 109 |
| Sweetclover | 250,000 | 12 |
| Winter wheat | 15,000 | 116 |

*Pure Live Seed (PLS) = percent germination x percent purity. Sources: Sulc and Barker (2005), Jennings (undated), Roberts (2000), Sattell et al. (1998), University of Arkansas (2010), Forage First (2008), Silver Farms Seed Company (2010) and Bailey Seed Company (2010). Blank cells indicate no information available.

Other Crops

Table 10 lists the seeding rates for additional crops grown from seed in the US. Crops that are produced from other types of propagation material (e.g., sets, transplants) are included as well.

**Table 10. Seeding Rates for Additional Crops.**

| Crop[1] | Propagation Material | Planting Method | End Use / Harvest Method[2] | Calculated Number of Seeds per Acre (Range) [3] | Row Width (inches) | In-Row Plant Spacing (inches) [4] | State | Reference |
|---|---|---|---|---|---|---|---|---|
| Alfalfa -- See Table 9 | | | | | | | | |
| Amaranth, Chinese (Chinese spinach) | Seeds | Direct seeding | Fresh market | 174,240 | 6" | 6" | Texas | Texas A & M University (2003?) |
| Artichoke, Globe | Crowns | Transplanted | Fresh market | 1,245 to 1,489 | 108 to 120" | 39 to 42" | California | Smith et al. (2008) |
| Artichoke, Globe | Transplants | Transplanted | Fresh market | 2,613 to 2,904 | 72 to 80" | 30" | California | Smith et al. (2008) |
| Artichoke, Jerusalem | Seed pieces | Transplanted | Fresh market | 5,445 to 14,520 | 36 to 48" | 12 to 24" | Oregon | Oregon State University (2004) |
| Arugula | Seeds | Direct seeding | Fresh market | 46,464 to 87,120 | 12 to 15" | 6 to 9" | Oregon | Oregon State University (2002) |
| Asparagus | Crowns | Transplanted | Fresh market | 17,424 to 34,848 | 60" bed (with 2 rows) | 6 to 12" | California | Mullen et al. (1998) |
| Asparagus | Crowns | Transplanted | Fresh market | 8,712 to 10,890 | 48 to 60" | 12" | New Jersey | Orton et al. (2010) |
| Asparagus | Crowns | Transplanted | Fresh market | 4,840 to 11,616 | 54 to 72" | 10 to 18" | New York | Sandsted et al. (Undated) |
| Asparagus | Crowns | Transplanted | Fresh market | 8,712 to 19,360 | 54 to 60" | 6 to 12" | North Carolina | Sanders (2001) |
| Asparagus | Crowns | Transplanted | Fresh market | 5,808 | 60" | 18" | Ohio | Precheur et al. (2010) |
| Asparagus | Crowns | Transplanted | Fresh market | 8,712 to 10,052 | 52 to 60" | 24" (dryland) | Oregon | Oregon State University (2002) |
| Asparagus | Crowns | Transplanted | Fresh market | 11,616 to 20,105 | 52 to 60" | 6 to 9" (irrigated) | Oregon | Oregon State University (2002) |
| Asparagus | Crowns | Transplanted | Fresh market | 8,712 to 10,890 | 48 to 60" | 12" | Deleware | Ernest et al. (2010) |
| Asparagus | Crowns | Transplanted | Fresh market | 8,712 to 9,680 | 54 to 60" | 12" | Pennsylvania | Orzolek et al. (2009) |
| Asparagus | Crowns / transplants | Transplanted | Fresh market | 5,808 to 11,616 | 54 to 60" | 10 to 18" | New York | Reiners and Petzoldt (2010) |
| Asparagus | Transplants | Transplanted | Fresh market | 8,712 to 9,680 | 54 to 60" | 12" | Deleware | Ernest et al. (2010) |
| Asparagus | Transplants | Transplanted | Fresh market | 8,712 to 9,680 | 54 to 60" | 12" | New Jersey | Orton et al. (2010) |
| Asparagus | Seeds | Direct seeding | Fresh market | 29,040 to 104,544 | 40 to 72" bed (with 2 rows) | 3 to 6" | California | Mullen et al. (1998) |
| Asparagus | Seeds | Direct seeding | Crown production | 8 to 10 lb / A | | | Oregon | Oregon State University (2004) |
| Asparagus | Seeds / Transplants | Direct seeding / Transplanted | Fresh market | 78,408 to 156,816 | 80" bed (with 2 rows) | 1 to 2" | Texas | Dainello (2003) |
| Asparagus | Transplants | Transplanted | Fresh market | 8,712 to 9,680 | 54 to 60" | 12" | Pennsylvania | Orzolek et al. (2009) |

| Crop[1] | Propagation Material | Planting Method | End Use / Harvest Method[2] | Calculated Number of Seeds per Acre (Range) [3] | Row Width (inches) | In-Row Plant Spacing (inches) [4] | State | Reference |
|---|---|---|---|---|---|---|---|---|
| Balsam pear (Bittermelon) | Seeds | Direct seeding | Fresh market | 1,452 to 2,904 | 60 to 72" | 36 to 60" | Florida | Lamberts et al. (2009) |
| Balsam pear (Bittermelon) | Seeds | Direct seeding | Fresh market | 4,356 to 9,680 | 36 to 60" | 18 to 24" | Ohio | Precheur et al. (2010) |
| Barley | Seeds | Drill seeding | food grain, forage | 72 to 96 lb / A | | | Kansas, eastern | USDA (2005) |
| Barley | Seeds | Drill seeding | food grain, forage | 30 to 48 lb / A | | | Kansas, western | USDA (2005) |
| Barley (2 rows) | Seeds | Direct seeding | Processing (malt) | 1,222,000 to 1,300,000 | | | North Dakota | Peel (2001) |
| Barley (6 rows) | Seeds | Direct seeding | Feed | 94 to 98 lb / A | | | North Dakota | Peel (2001) |
| Basil | Transplants | Transplanted | Fresh market | 21,780 to 69,696 | 15 to 36" | 6 to 8" | Indiana | Egel et al. (2010) |
| Bean, Broad (Faba) | Seeds | Direct seeding | Fresh market | 29,040 to 52,272 | 24 to 36" | 5 to 6" | Oregon | Oregon State University (2002) |
| Bean, Dry common | Seeds | Direct seeding | Processing (seeds) | 69,696 to 104,544 | 30" bed (with 1 row) | 4 to 6 seeds / ft | California | Long et al. (2010) |
| Bean, Dry common | Seeds | Direct seeding | Processing (seeds) | 58,080 to 112,011 | 28 to 36" | 2 to 3" | Ohio | Precheur et al. (2010) |
| Bean, Dry common (pinto) | Seeds | Direct seeding | Processing (seeds) | 78,408 to 130,680 | 2 rows 40" wide | 3 to 5 plants / ft | Texas | Dainello (2003) |
| Bean, Goa (Winged bean) | Seeds | Direct seeding | Fresh market | 21,780 | 36" | 8" | Florida | Lamberts et al. (2009) |
| Bean, Hyacinth | Seeds | Direct seeding | Fresh market | 52,272 to 78,408 | 20" | 4 to 6" | Florida | Lamberts et al. (2009) |
| Bean, Lima | Seeds | Direct seeding | Fresh market | 29,040 to 34,848 | 30 to 36" | 2 plants / ft | Indiana | Orton et al. (2010) |
| Bean, Lima | Seeds | Direct seeding | Fresh market / processing | 43,560 to 69,696 | 30 to 36" | 3 to 4" | Ohio | Precheur et al. (2010) |
| Bean, Lima | Seeds | Direct seeding | Fresh market | 43,560 to 95,040 | 22 to 36" | 3 to 4" | Oregon | Oregon State University (2004) |
| Bean, Lima (baby) | Seeds | Direct seeding | Fresh market | 43,560 to 69,696 | 30 to 36" | 3 to 4” | Indiana | Orton et al. (2010) |
| Bean, Lima (baby) | Seeds | Direct seeding | Fresh market / processing | 43,560 to 69,696 | 30 to 36" | 3 to 4" | Pennsylvania | Orzolek et al. (2009) |
| Bean, Lima (Fordhook) | Seeds | Direct seeding | Fresh market / processing | 29,040 to 34,848 | 30 to 36" | 6" | Pennsylvania | Orzolek et al. (2009) |
| Bean, Succulent common | Seeds | Direct seeding | Fresh market | 87,120 to 174,240 | 30 to 36" | 6 to 10 plants / ft | Delaware | Ernest et al. (2010) |
| Bean, Succulent common | Seeds | Direct seeding | Fresh market | 108,900 to 204,988 | 18 to 24" | 5 to 7 plants / ft | Delaware | Ernest et al. (2010) |
| Bean, Succulent common | Seeds | Direct seeding | Fresh market / processing | 72,600 to 204,988 | 18 to 36" | 5 to 7 seeds / ft | Indiana | Egel et al. (2010) |
| Bean, Succulent common | Seeds | Direct seeding | Fresh market / processing | 87,120 to 174,240 | 30 to 36" | 6 to 10 plants / ft | New Jersey | Orton et al. (2010) |
| Bean, Succulent common | Seeds | Direct seeding | Fresh market / processing | 87,120 to 104,544 | 30 to 36" | 2" | New York | USDA (1999) |
| Bean, Succulent | Seeds | Direct seeding | Fresh market / | 87,120 to 139,392 | 30 to 36" | 1.5 to 2" | Ohio | Precheur et al. (2010) |

| Crop[1] | Propagation Material | Planting Method | End Use / Harvest Method[2] | Calculated Number of Seeds per Acre (Range) [3] | Row Width (inches) | In-Row Plant Spacing (inches) [4] | State | Reference |
|---|---|---|---|---|---|---|---|---|
| common | | | processing | | | | | |
| Bean, Succulent common | Seeds | Direct seeding (narrow row) | Fresh market / processing | 108,900 to 204,988 | 18 to 24" | 1.7 to 2.4" | Pennsylvania | Orzolek et al. (2009) |
| Bean, Succulent common | Seeds | Direct seeding (wide row) | Fresh market / processing | 87,120 to 174,240 | 30 to 36" | 1.2 to 2” | Pennsylvania | Orzolek et al. (2009) |
| Bean, Succulent common | Seeds | Direct seeding | Fresh market | 78,408 to 82,535 | 38 to 40" | 2" | Texas | Dainello (2003) |
| Bean, Succulent common (pole) | Seeds | Direct seeding (drilled) | Fresh market | 50 to 80 lb / A | | | Georgia | Mclaurin and Granberry (2009) |
| Bean, Succulent common (pole) | Seeds | Direct seeding (hill planted) | Fresh market | 20 to 30 lb / A | | | Georgia | Mclaurin and Granberry (2009) |
| Bean, Yardlong | Seeds | Direct seeding | Fresh market | 43,560 to 112,011 | 28 to 36" | 2 to 4" | Florida | Lamberts et al. (2009) |
| Bean, Yardlong | Seeds | Direct seeding | Fresh market | 52,272 to 104,544 | 30 to 40" | 2 to 3" | Texas | Texas A & M University (2003?) |
| Beans, Succulent common | Seeds | Direct seeding | Seed | 139,392 to 418,176 | 15 to 30" | 8 to 12 seeds / ft | Oregon | Oregon State University (2004) |
| Beet, Garden | Seeds | Direct seeding | Fresh market | 52,272 to 98,010 | 32 to 40" | 2 to 3" | California | Schrader and Mayberry (2003) |
| Beet, Garden | Seeds | Direct seeding | Fresh market | 392,040 to 633,600 | 15 to 20" | 15 to 18 seeds / ft (thin to 3") | Delaware | Ernest et al. (2010) |
| Beet, Garden | Seeds | Direct seeding | Fresh market | 8 to 10 lb / A | | | Indiana | Egel et al. (2010) |
| Beet, Garden | Seeds | Direct Seeding | Fresh market | 8 to 10 lb / A | | | New York | Reiners and Petzoldt (2010) |
| Beet, Garden | Seeds | Direct Seeding | Processing | 15 to 25 lb / A | | | New York | Reiners and Petzoldt (2010) |
| Beet, Garden | Seeds | Direct seeding | Fresh market | 261,360 to 522,720 | 12 to 16" | thin plants to 2 to 3" apart" | Ohio | Precheur et al. (2010) |
| Beet, Garden | Seeds | Direct seeding | Fresh market | 1,045,440 | 10 to 15" | 24 seeds/ft row | Oregon | Oregon State University (2004) |
| Beet, Garden | Seeds | Direct seeding | Fresh market / processing | 392,040 to 633,600 | 15 to 20" | 15 to 18 seeds / ft (thin to 3") | Pennsylvania | Orzolek et al. (2009) |
| Beet, Garden | Seeds | Direct seeding | Fresh market | 156,816 to 174,240 | 38 to 40" bed (with 2 rows) | 2" | Texas | Dainello (2003) |
| Beet, Garden (baby) | Seeds | Direct seeding | Processing (pickling) | 1,045,440 to 1,844,894 | 10 to 15” | 30 to 35 plants / ft | California | Schrader and Mayberry (2003) |
| Beet, Garden (baby) | Seeds | Direct seeding | Fresh market | 1,393,920 to 2,090,880 | 10 to 15" | 30 to 35 plants / ft | Oregon | Oregon State University (2004) |
| Bermudagrass, Common -- See Table 9 | | | | | | | | |
| Big bluestem -- See Table 9 | | | | | | | | |
| Birdsfoot trefoil -- See Table 9 | | | | | | | | |

| Crop[1] | Propagation Material | Planting Method | End Use / Harvest Method[2] | Calculated Number of Seeds per Acre (Range) [3] | Row Width (inches) | In-Row Plant Spacing (inches) [4] | State | Reference |
|---|---|---|---|---|---|---|---|---|
| Bluegrass, Kentucky -- See Table 9 | | | | | | | | |
| Broccoli | Seeds | Direct seeding | Fresh market | 10,454 to 26,136 | 24 to 40" | 10 to 15" | Florida | Olson et al. (2009) |
| Broccoli | Seeds | Direct seeding | Fresh market | 21,780 to 52,272 | 20 to 36" | 6 to 8" | Michigan | Zandstra et al. (1988) |
| Broccoli | Seeds | Direct seeding | Fresh market | 9,680 to 14,520 | 36" | 12 to 18" | New Jersey | Orton et al. (2010) |
| Broccoli | Seeds | Direct seeding | Fresh market | 147,592 to 210,845 | 17" bed (with 3 to 4 rows) | 7 to 10" | New York | Reiners and Petzoldt (2010) |
| Broccoli | Seeds | Direct seeding | Fresh market / processing | 20,909 to 28,003 | 20 to 30 " | 8 to 10 " | Oregon | Oregon State University (2004) |
| Broccoli | Seeds | Direct seeding | Fresh market / processing | 9,680 to 14,520 | 36" | 12 to 18" | Pennsylvania | Orzolek et al. (2009) |
| Broccoli | Seeds / Transplants | Direct seeding / Transplanted | Fresh market | 10,668 to 13,756 | 38 to 42" bed (2 rows) | 12 to 14" | California | LeStrange et al.(1997) |
| Broccoli | Seeds / Transplants | Direct seeding / transplanted | Fresh market | 34,848 to 87,120 | 24 to 40" bed (with 1 or 2 rows) | 6 to 9" | Texas | Dainello (2003) |
| Broccoli | Transplants | Transplanted | Fresh market | 14,520 to 21,780 | 24 to 36" | 12" | Michigan | Zandstra et al. (1988) |
| Broccoli | Transplants | Transplanted | Fresh market | 9,680 to 14,520 | 36" | 12 to 18" | New Jersey | Orton et al. (2010) |
| Broccoli | Transplants | Transplanted | Fresh market | 9,680 to 21,780 | 24 to 36" | 12 to 18" | New York | Reiners and Petzoldt (2010) |
| Broccoli | Transplants | Transplanted | Fresh market / processing | 9,680 to 14,520 | 36" | 12 to 18" | Pennsylvania | Orzolek et al. (2009) |
| Broccoli | Seeds | Direct seeding | Fresh market | 62,726 to 69,696 | 40" bed (with 2 rows) | 4.5 to 5" | California | University of California (2002) |
| Broccoli | Seeds | Direct seeding | Fresh market | 62,726 | 40" bed (with 2 rows) | 5" | California | Takele (1999?) |
| Broccoli | Seeds | Direct seeding | Fresh market | 8,297 to 13,756 | 38 to 42" | 12 to18" | Delaware | Ernest et al. (2010) |
| Broccoli | Seeds | Direct seeding | Fresh market | 49,005 to 98,010 | 36" beds (with 2 rows) | 4 to 8" | Ohio | Precheur et al. (2010) |
| Broccoli | Seeds | Direct seeding | Fresh market | 65,340 to 78,408 | 16" | 5 to 6" | Ohio | Precheur et al. (2010) |
| Broccoli | Seeds / Transplants | Direct seeded / Transplanted | Fresh market | 9,680 to 14,520 | 36" | 12 to 18" | Indiana | Egel et al. (2010) |
| Broccoli | Seeds / Transplants | Direct seeding / transplanted | Processing | 20,909 to 58,080 | 24 to 40" bed (with 1 or 2 rows) | 9 to 15" | Texas | Dainello (2003) |
| Broccoli (bunched) | Seeds | Direct seeding | Fresh market | 31,363 to 38,720 | 18 to 20" | 9 to 10" | New Jersey | Orton et al. (2010) |
| Broccoli (bunched) | Seeds / Transplants | Direct seeding / transplanted | Fresh market / processing | 125,453 to 154,880 | 18 to 20" bed (with 2 to 4 rows) | 9 to 10" | Pennsylvania | Orzolek et al. (2009) |
| Broccoli, Chinese | Seeds | Direct seeding | Fresh market | 114,048 to 190,080 | 44"bed (with 3 to 4 rows) | 3 to 5" | Florida | Lamberts et al. (2009) |
| Bromegrass, Smooth -- See Table 9 | | | | | | | | |

| Crop[1] | Propagation Material | Planting Method | End Use / Harvest Method[2] | Calculated Number of Seeds per Acre (Range) [3] | Row Width (inches) | In-Row Plant Spacing (inches) [4] | State | Reference |
|---|---|---|---|---|---|---|---|---|
| Brussels sprouts | Seeds | Transplanted | Fresh market | 11,616 | 36" | 15" | Delaware | Ernest et al. (2010) |
| Brussels sprouts | Seeds | Direct seeding | Fresh market | 6,534 to 14,520 | 24 to 40" | 18 to 24" | Florida | Olson et al. (2009) |
| Brussels sprouts | Seeds | Transplanted | Fresh market | 7,260 to 7,687 | 34 to 36" | 24" | New York | Reiners and Petzoldt (2010) |
| Brussels sprouts | Seeds | Direct seeding | Fresh market | 7,260 to 14,520 | 36" | 12 to 24" | Ohio | Precheur et al. (2010) |
| Brussels sprouts | Seeds | Direct seeding | Fresh market / processing | 20,908 to 27,878 | 30 to 40" | 2 seeds every 15" | Oregon | Oregon State University (2004) |
| Brussels sprouts | Seeds / Transplants | Direct seeded / Transplanted | Fresh market | 7,260 to 9,680 | 36" | 18 to 24" | Indiana | Egel et al. (2010) |
| Brussels sprouts | Transplants | Transplanted | Fresh market | 7,260 | 36" | 24" | Michigan | Zandstra et al. (1988) |
| Brussels sprouts | Transplants | Transplanted | Fresh market | 11,616 | 36" | 15" | New Jersey | Orton et al. (2010) |
| Brussels sprouts | Transplants | Transplanted | Fresh market | 11,616 | 36" | 15" | Ohio | Precheur et al. (2010) |
| Brussels sprouts | Transplants | Transplanted | Fresh market / processing | 8,712 to 10,890 | 36 to 40" | 16 to 18" | Oregon | Oregon State University (2004) |
| Brussels sprouts | Transplants | Transplanted | Fresh market / processing | 11,616 | 36" | 15" | Pennsylvania | Orzolek et al. (2009) |
| Buckwheat | Seeds | Drill seeded | | 36 to 72 lbs / A | | | Indiana | Oplinger et al. (1989) |
| Cabbage | Seeds | Transplanted | Fresh market | 9,957 to 14,520 | 36 to 42" | 12 to 15" | Alabama | Kemble et al. (1999) |
| Cabbage | Seeds | Direct seeding | Fresh market | 22,402 to 26,136 | 40" bed (with 2 rows) | 12 to 14" | California | Daugovish et al. (2008) |
| Cabbage | Seeds | Transplanted | Fresh market | 9,680 to 29,040 | 24 to 36" | 9 to 18" | Delaware | Ernest et al. (2010) |
| Cabbage | Seeds | Direct seeding | Fresh market | 9,801 to 29,040 | 24 to 40" | 9 to 16" | Florida | Olson et al. (2009) |
| Cabbage | Seeds | Direct seeding | Fresh market | 8,712 to 17,424 | 30 to 36" | 12 to 20” | Michigan | Zandstra et al. (1988) |
| Cabbage | Seeds | Transplanted | Fresh market | 9,680 to 17,424 | 30 to 36" | 12 to 18” | Michigan | Zandstra et al. (1988) |
| Cabbage | Seeds | Direct seeding | Processing (kraut) | 7,260 to 14,520 | 24 to 36" | 18 to 24" | New York | Reiners and Petzoldt (2010) |
| Cabbage | Seeds | Direct seeding | Processing | 52,272 to 98,010 | 16 to 20" | 4 to 6" | Ohio | Precheur et al. (2010) |
| Cabbage | Seeds | Direct seeding | Fresh market / processing | 46,464 to 55,757 | 15 to 18" | 15" (2 seeds) | Oregon | Oregon State University (2004) |
| Cabbage | Seeds / Transplants | Direct seeding / transplanted | Fresh market | 14,520 to 19,360 | 36" | 9 to 12" | Georgia | Kelley et al. (2009) |
| Cabbage | Seeds / Transplants | Direct seeded / Transplanted | Fresh market | 11,616 to 21,780 | 24 to 36" | 12 to 15" | Indiana | Egel et al. (2010) |
| Cabbage | Seeds / Transplants | Direct seeded / Transplanted | Processing (kraut) | 9,680 | 36" | 18" | Indiana | Egel et al. (2010) |
| Cabbage | Seeds / Transplants | Direct seeding / Transplanted | Fresh market | 12,446 to 26,136 | 24 to 36" | 10 to 14" | New York | Reiners and Petzoldt (2010) |
| Cabbage | Seeds / Transplants | Direct seeding / transplanted (early planting) | Fresh market / processing | 11,616 to 29,040 | 24 to 36" | 9 to 15" | Pennsylvania | Orzolek et al. (2009) |
| Cabbage | Seeds / | Direct seeding | Fresh market / | 7,260 to 19,360 | 36 to 48" | 9 to 18" | Pennsylvania | Orzolek et al. (2009) |

| Crop[1] | Propagation Material | Planting Method | End Use / Harvest Method[2] | Calculated Number of Seeds per Acre (Range) [3] | Row Width (inches) | In-Row Plant Spacing (inches) [4] | State | Reference |
|---|---|---|---|---|---|---|---|---|
| | Transplants | / transplanted (late planting) | processing | | | | | |
| Cabbage | Seeds / Transplants | Direct seeding / transplanted | Fresh market | 26,136 to 87,120 | 24 to 40" bed (with 1 or 2 rows) | 6 to 12” | Texas | Dainello (2003) |
| Cabbage | Seeds / Transplants | Direct seeding / transplanted | Processing | 20,909 to 58,080 | 24 to 40" bed (with 1 or 2 rows) | 9 to 15" | Texas | Dainello (2003) |
| Cabbage | Transplants | Transplanted | Fresh market | 10,890 to 29,040 | 24 to 36" | 9 to 16" | Florida | Li et al. (2009) |
| Cabbage | Transplants | Transplanted | Fresh market | 9,680 to 29,040 | 24 to 36" | 9 to 15"; 9 to 18 early planting | New Jersey | Orton et al. (2010) |
| Cabbage | Transplants | Transplanted | Processing | 15,682 to 28,003 | 16 to 20" | 14 to 20" | Ohio | Precheur et al. (2010) |
| Cabbage, Chinese | Seeds | Direct seeding | Fresh market | 14,520 to 32,003 | 44" bed (with 2 to 3 rows) | 14 to 18" | Florida | Lamberts et al. (2009) |
| Cabbage, Chinese | Seeds | Direct seeding | Fresh market | 21,780 to 13,068 | 24" | 12 to 20" | Oregon | Oregon State University (2002) |
| Cabbage, Chinese | Seeds / Transplants | Direct seeding / Transplanted | Fresh market | 17,424 to 52,272 | 24 to 40" bed (with 1 or 2 rows) | 10 to 18" | Texas | Dainello (2003) |
| Canarygrass, Reed -- See Table 9 | | | | | | | | |
| Canola – See Rape | | | | | | | | |
| Cardoon | Seeds / stem pieces | Direct seeding / Transplanted | | 5,445 to 9,680 | 36 to 48" | 18 to 24" | Oregon | Oregon State University (2004) |
| Carrot | Seeds | Direct seeding | Fresh market / processing | 900,000 to 1,300,000 | | | California | Nunez et al. (2008) |
| Carrot | Seeds | Direct seeding | Processing | 104,544 to 156,816 | 20 to 30" | 2" | Delaware | Ernest et al. (2010) |
| Carrot | Seeds | Direct seeding | Fresh market | 348,480 to 980,100 | 16 to 30" | 20 to 30 seeds/ft | Indiana | Egel et al. (2010) |
| Carrot | Seeds | Direct seeding | Processing (dicing) | 174,240 to 653,400 | 16 to 30" | 10 to 20 seeds/ft | Indiana | Egel et al. (2010) |
| Carrot | Seeds | Direct seeding | Processing | 278,784 to 418,176 | 20 to 30" | 16 plants/ft | New Jersey | Orton et al. (2010) |
| Carrot | Seeds | Direct seeding | Processing (dicing) | 104,544 to 156,816 | 20 to 30" | 6 plants/ft | New Jersey | Orton et al. (2010) |
| Carrot | Seeds | Direct seeding | Fresh market / processing | 261,360 to 696,960 | 18 to 36" bed (with 3 rows) | 1.5 to 2" | New York | Reiners and Petzoldt (2010) |
| Carrot | Seeds | Direct seeding | Fresh market | 1,858,560 to 2,090,880 | 16 to 18" bed (with 3 or 4 rows) | 16 plants/ft | Ohio | Precheur et al. (2010) |
| Carrot | Seeds | Direct seeding | Fresh market / processing | 2 to 4 lb / A | | | Oregon | Oregon State University (2004) |

| Crop[1] | Propagation Material | Planting Method | End Use / Harvest Method[2] | Calculated Number of Seeds per Acre (Range) [3] | Row Width (inches) | In-Row Plant Spacing (inches) [4] | State | Reference |
|---|---|---|---|---|---|---|---|---|
| Carrot | Seeds | Direct seeding | Processing (dicing) | 1 to 2 lb / A | | | Oregon | Oregon State University (2004) |
| Carrot | Seeds | Direct seeding | Processing | 104,544 to 418,176 | 20 to 30" | 6 to 16 plants / ft | Pennsylvania | Orzolek et al. (2009) |
| Carrot | Seeds | Direct seeding | Fresh market | 497,829 to 995,657 | 38 to 40" bed (with 4 to 6 rows) | 1 to 2" | Texas | Dainello (2003) |
| Cassava | Stem pieces | Direct planting | Fresh market | 5,445 | 48" | 24" | Florida | Lamberts and Olson (2009) |
| Cauliflower | Seeds | Direct seeding | | 5,445 to 9,680 | 36 to 48" | 18 to 24" | Delaware | Ernest et al. (2010) |
| Cauliflower | Seeds | Direct seeding | Fresh market | 8,712 to 21,780 | 24 to 40" | 12 to 18" | Florida | Olson et al. (2009) |
| Cauliflower | Seeds | Direct seeding | Fresh market | 6,534 to 10,890 | 36 to 40" | 16 to 24" | Michigan | Zandstra et al. (1988) |
| Cauliflower | Seeds | Direct seeding | Fresh market | 9,680 to 12,299 | 34 to 36" | 15 to 18" | New York | Reiners and Petzoldt (2010) |
| Cauliflower | Seeds | Direct seeding | Fresh market / processing | 17,424 to 23,232 | 36 to 40" | 15 to 18" (2 seeds) | Oregon | Oregon State University (2004) |
| Cauliflower | Seeds / Transplants | Direct seeded / Transplanted | Fresh market | 9,680 to 11,616 | 36" | 15 to 18" | Indiana | Egel et al. (2010) |
| Cauliflower | Seeds / Transplants | Direct seeding / transplanted | Fresh market | 8,712 to 14,520 | 36 to 40" | 12 to 18" | Texas | Dainello (2003) |
| Cauliflower | Transplants | Transplanted | Fresh market | 13,068 to 13,068 | 40" | 12" | California | Koike et al. (2009) |
| Cauliflower | Transplants | Transplanted | Fresh market | 6,534 to 9,680 | 36 to 40" | 18 to 24" | Michigan | Zandstra et al. (1988) |
| Cauliflower | Transplants | Transplanted | Fresh market | 5,445 to 9,680 | 36 to 48" | 18 to 24" | New Jersey | Orton et al. (2010) |
| Cauliflower | Transplants | Direct seeding | Fresh market | 7,260 to 14,520 | 36" | 12 to 24" | Ohio | Precheur et al. (2010) |
| Cauliflower | Transplants | Transplanted | Fresh market / processing | 5,445 to 9,680 | 36 to 48" | 18 to 24" | Pennsylvania | Orzolek et al. (2009) |
| Celery | Transplants | Transplanted | Fresh market | 34,848 to 38,720 | 36 to 40" bed (with 2 rows) | 9" | California | Daugovish et al. (2008) |
| Celery | Transplants | Transplanted | Fresh market | 24,503 to 49,005 | 16 to 32" | 8" | Delaware | Ernest et al. (2010) |
| Celery | Transplants | Transplanted | Fresh market | 24,503 to 49,005 | 16 to 32" | 8" | New Jersey | Orton et al. (2010) |
| Celery | Transplants | Transplanted | Fresh market | 30,000 to 45,000 | | | New York | Reiners and Petzoldt (2010) |
| Celery | Transplants | Transplanted | Fresh market | 39,204 to 69,696 | 15 to 20" | 6 to 8" | Oregon | Oregon State University (2002) |
| Celery | Transplants | Transplanted | Fresh market | 24,503 to 49,005 | 16 to 32" | 8" | Pennsylvania | Orzolek et al. (2009) |
| Celery | Transplants | Transplanted | Fresh market | 39,204 to 52,272 | 40" bed (with 2 rows) | 6 to 8" | Texas | Dainello (2003) |
| Chayote | Seeds | Direct seeding | Fresh market | 1,452 to 2,904 | 60 to 72" | 36 to 60" | Florida | Lamberts et al. (2009) |
| Chicory (forage) -- See Table 9 | | | | | | | | |
| Chicory (Radicchio) | Seeds | Direct seeding | Fresh market | 29,040 to 52,272 | 15 to 18" | 8 to 12" | Oregon | Oregon State University (2003) |
| Chinese squash (Chinese wintermelon) | Seeds | Direct seeding | Fresh market | 1,210 to 1,742 | 60 to 72" | 60 to 72" | Florida | Lamberts et al. (2009) |

| Crop[1] | Propagation Material | Planting Method | End Use / Harvest Method[2] | Calculated Number of Seeds per Acre (Range) [3] | Row Width (inches) | In-Row Plant Spacing (inches) [4] | State | Reference |
|---|---|---|---|---|---|---|---|---|
| Chinese squash (Fuzzy melon) | Seeds | Direct seeding | Fresh market | 1,452 to 2,904 | 60 to 72" | 36 to 60" | Florida | Lamberts et al. (2009) |
| Cilantro | Seeds | Direct seeding | Fresh market | 313,632 to 896,091 | 38 to 40" | 2 to 4 plants/sq inch of seedline | California | Laemmlen and Smith (1998) |
| Cilantro | Seeds | Direct seeding | Fresh market | 25 to 50 lb / A | | | Texas | Dainello (2003) |
| Clover, Alsike -- See Table 9 | | | | | | | | |
| Clover, Arrowleaf -- See Table 9 | | | | | | | | |
| Clover, Berseem -- See Table 9 | | | | | | | | |
| Clover, Crimson -- See Table 9 | | | | | | | | |
| Clover, Kura -- See Table 9 | | | | | | | | |
| Clover, Red -- See Table 9 | | | | | | | | |
| Clover, Rose -- See Table 9 | | | | | | | | |
| Clover, White -- See Table 9 | | | | | | | | |
| Collards | Seeds | Direct seeding | Fresh market | 7,260 to 21,780 | 24 to 36" | 12 to 24" | Florida | Olson et al. (2009) |
| Collards | Seeds | Direct Seeding | Fresh market | 2 to 4 lb | | | Ohio | Precheur et al. (2010) |
| Collards | Seeds / Transplants | Direct seeded / Transplanted | Fresh market | 6,223 to 9,680 | 36 to 42" | 18 to 24" | Indiana | Egel et al. (2010) |
| Collards | Seeds / Transplants | Direct seeding / transplanted | Fresh market | 43,560 to 65,340 | 16 to 24" | 6" | Pennsylvania | Orzolek et al. (2009) |
| Collards | Transplants | Transplanted | Fresh market | 43,560 to 65,340 | 16 to 24" | 6" | New Jersey | Orton et al. (2010) |
| Collards | Transplants | Transplanted | Fresh market | 65,340 to 74,674 | 14 to 16" | 6" | Ohio | Precheur et al. (2010) |
| Corn (Baby corn) | Seeds | Direct seeding | Processing | 23,000 to 44,000 | 24 to 36" | not given | Oregon | Lamberts et al. (2009) |
| Corn (Field) -- See Table 4 | | | | | | | | |
| Corn (Popcorn) | Seeds | Direct seeding | Processing | 24,000 to 30,000 | | not given | Ohio | Freytag et al. (2008) |
| Corn (Popcorn) | Seeds | Direct seeding | seeds | 20,000 to 30,000 | | | Oregon | Oregon State University (2002) |
| Corn (Sweet corn) | Seeds | Direct seeding | Fresh market | 15,682 to 24,891 | 36 to 40" | 7 to 10" | California | Smith et al. (1997) |
| Corn (Sweet corn) | Seeds | Direct seeding | Fresh market | 19,008 to 59,739 | 30 to 66" bed (with 1 or 2 rows) | 7 to 10" | California | Smith et al. (1997) |
| Corn (Sweet corn) | Seeds | Direct seeding | Fresh market | 14,520 to 19,360 | 36" | 9 to 12" large eared var. | Delaware | Ernest et al. (2010) |
| Corn (Sweet corn) | Seeds | Direct seeding | Fresh market | 17,424 to 21,780 | 36" | 8 to 10" | Delaware | Ernest et al. (2010) |
| Corn (Sweet corn) | Seeds | Direct seeding | Fresh market | 24,503 to 37,337 | 28 to 32" | 6 to 8" | Florida | Li et al. (2009) |
| Corn (Sweet corn) | Seeds | Direct seeding | Fresh market | 21,780 to 37,337 | 28 to 36" | 6 to 8" | Florida | Ozores-Hampton et al. (2009) |
| Corn (Sweet corn) | Seeds | Direct seeding | Fresh market | 13,068 to 26,136 | 30 to 40" | 8 to 12" | Indiana, Illinois | Egel et al. (2010) |
| Corn (Sweet corn) | Seeds | Direct seeding | Fresh market / processing | 14,520 to 26,136 | 30 to 36" | 8 to 12" | New York | USDA (1999) |
| Corn (Sweet corn) | Seeds | Direct seeding | Fresh market | 14,520 to 26,136 | 30 to 36" | 8 to 12" | Ohio | Precheur et al. (2010) |

| Crop[1] | Propagation Material | Planting Method | End Use / Harvest Method[2] | Calculated Number of Seeds per Acre (Range) [3] | Row Width (inches) | In-Row Plant Spacing (inches) [4] | State | Reference |
|---|---|---|---|---|---|---|---|---|
| Corn (Sweet corn) | Seeds | Direct seeding | Fresh market / processing | 21,780 to 34,848 | 30 to 36" | 6 to 8" | Oregon | Oregon State University (2004) |
| Corn (Sweet corn) | Seeds | Direct seeding | Fresh market | 13,068 to 26,136 | 30 to 40" | 8 to 12" | Texas | Dainello (2003) |
| Corn (Sweet corn) (early varieties) | Seeds | Direct seeding | Fresh market / processing | 17,424 to 21,780 | 36" | 8 to 10" | New Jersey | Orton et al. (2010) |
| Corn (Sweet corn) (early varieties) | Seeds | Direct seeding | Fresh market / processing | 26,136 to 34,848 | 30 " | 6 to 8" | Oregon | Oregon State University (2004) |
| Corn (Sweet corn) (early varieties, smaller eared) | Seeds | Direct seeding | Fresh market | 17,424 to 21,780 | 36" | 8 to 10" | Pennsylvania | Orzolek et al. (2009) |
| Corn (Sweet corn) (late varieties) | Seeds | Direct seeding | Fresh market / processing | 14,520 to 17,424 | 36" | 10 to 12" | New Jersey | Orton et al. (2010) |
| Corn (Sweet corn) (late varieties) | Seeds | Direct seeding | Fresh market / processing | 14,520 to 23,232 | 30 to 36" | 9 to 12" | Oregon | Oregon State University (2004) |
| Corn (Sweet corn) (late varieties, larger eared) | Seeds | Direct seeding | Fresh market | 14,520 to 17,424 | 36" | 10 to 12" | Pennsylvania | Orzolek et al. (2009) |
| Cotton | Seeds | Direct seeding | Processing | 39,204 to 55,023 | 38 to 40" | 3 to 4 plants / ft | Mississippi | Mississippi State University Extension (2009) |
| Cotton | Seeds | Direct seeding | Processing | 30,000 to 60,000 | | | Oklahoma | Verhalen et al. (Undated) |
| Cotton – Also see Table 6 | | | | | | | | |
| Cotton (15"row) | Seeds | Direct seeding | Processing | 29,000 to 58,000 | 15" | | Tennessee | Gwathmey et al. (2010) |
| Cotton (30" row) | Seeds | Direct seeding | Processing | 29,000 to 43,000 | 30" | | Tennessee | Gwathmey et al. (2010) |
| Crownvetch -- See Table 9 | | | | | | | | |
| Cucumber | Seeds | Direct seeding | Fresh market / processing | 7,260 to 21,780 | 36 to 72" | 8 to 12" | California | Schrader et al. (2002) |
| Cucumber | Seeds | Direct seeding | Fresh market | 8,712 to 21,780 | 48 to 60" | 6 to 12" | Florida | Olson et al. (2010) |
| Cucumber | Seeds | Direct seeding | Fresh market | 8,712 to 21,780 | 48 to 60" | 6 to 12" | Florida | Olson et al. (2010) |
| Cucumber | Seeds | Direct seeding | Fresh market | 10,890 to 19,360 | 36 to 48" | 9 to 12" | New Jersey | Orton et al. (2010) |
| Cucumber | Seeds | Direct seeding | Processing (hand harvest)(pickles) | 16,335 to 29,040 | 36 to 48" | 6 to 8 " | New Jersey | Orton et al. (2010) |
| Cucumber | Seeds | Direct seeding | Processing (machine harvest)(pickles) | 41,818 to 80,418 | 26 to 30" | 3 to 5" | New Jersey | Orton et al. (2010) |
| Cucumber | Seeds | Direct seeding | Fresh market / processing | 5,808 to 10,454 | 60 to 72" | 10 to 15" | New York | USDA (1999) |
| Cucumber | Seeds | Direct seeding | Fresh market | 7,260 to 19,360 | 36 to 72" | 9 to 12" | Ohio | Precheur et al. (2010) |
| Cucumber | Seeds | Direct seeding | Processing (machine harvest) | 34,848 to 139,392 | 15 to 30 | 3 to 6" | Ohio | Precheur et al. (2010) |
| Cucumber | Seeds | Direct seeding | Processing (hand | 7,260 to 29,040 | 36 to 72" | 6 to 12" | Ohio | Precheur et al. (2010) |

| Crop[1] | Propagation Material | Planting Method | End Use / Harvest Method[2] | Calculated Number of Seeds per Acre (Range) [3] | Row Width (inches) | In-Row Plant Spacing (inches) [4] | State | Reference |
|---|---|---|---|---|---|---|---|---|
| | | | pick) | | | | | |
| Cucumber | Seeds / Transplants | Direct seeding / Transplanted | Fresh market | 10,890 to 19,360 | 36 to 48" | 9 to 12" | Delaware | Ernest et al. (2010) |
| Cucumber | Seeds / Transplants | Direct seeding / Transplanted | Processing (hand harvest) | 16,335 to 29,040 | 36 to 48" | 6 to 8" | Delaware | Ernest et al. (2010) |
| Cucumber | Seeds / Transplants | Direct seeding / Transplanted | Processing (machine harvest) | 41,818 to 80,418 | 26 to 30" | 3 to 5" | Delaware | Ernest et al. (2010) |
| Cucumber | Seeds / Transplants | Direct seeding / transplanted | Fresh market | 7,260 to 16,335 | 48 to 72" | 8 to 12" | Oregon | Oregon State University (2002) |
| Cucumber | Seeds / Transplants | Direct seeding / transplanted | Processing (hand harvest)(pickles) | 26,136 to 52,272 | 40" bed (with 1 row) | 3 to 6 " | Texas | Dainello (2003) |
| Cucumber | Seeds / Transplants | Direct seeding / transplanted | Processing (machine harvest)(pickles) | 39,302 | 80" bed (with 3 rows) | 6" | Texas | Dainello (2003) |
| Cucumber | Seeds | Direct seeding | Fresh market | 4,840 to 8,712 | 48 to 72" | 15 to 18" | Indiana | Egel et al. (2010) |
| Cucumber | Seeds | Direct seeding | Processing, machine harvest (pickles) | 44,804 to 69,696 | 18 to 20" | 5 to 7" | Indiana | Egel et al. (2010) |
| Cucumber | Seeds | Direct seeding | Fresh market | 5,808 to 10,454 | 60 to 72" | 10 to 15" | New York | Reiners and Petzoldt (2010) |
| Cucumber | Seeds | Direct seeding | Fresh market / processing | 13,068 to 87,120 | 24 to 60" | 3 to 8" | New York | Reiners and Petzoldt (2010) |
| Cucumber | Seeds | Direct seeding | Fresh market (hand harvest) | 10,890 to 19,360 | 36 to 48" | 9 to 12" | Pennsylvania | Orzolek et al. (2009) |
| Cucumber | Seeds | Direct seeding | Processing, 84" Machine Harvested (pickles) | 44,805 to 60,314 | 26 to 28" | 4 to 5" | Pennsylvania | Orzolek et al. (2009) |
| Cucumber | Seeds | Direct seeding | Processing, 90" Machine Harvested, (pickles) | 52,272 to 69,696 | 30" | 3 to 4" | Pennsylvania | Orzolek et al. (2009) |
| Cucumber | Seeds | Direct seeding | Processing, hand harvest (pickles) | 16,335 to 29,040 | 36 to 48" | 6 to 8" | Pennsylvania | Orzolek et al. (2009) |
| Cucumber | Seeds | Direct seeding | Fresh market | 15,682 to 26,136 | 40" bed (with 1 row) | 6 to 10" in row | Texas | Dainello (2003) |
| Dill | Seeds | Direct seeding | Fresh market | 1 to 2 lb / A | | | Oregon | Oregon State University (2002) |
| Dill | Seeds | Direct seeding | Processing (oil) | 5 to 8 lb / A | | | Oregon | Oregon State University (2002) |
| Eggplant | Seeds | Transplanted | Fresh market | 2,904 to 5,445 | 48 to 60" | 24 to 36" | Delaware | Ernest et al. (2010) |
| Eggplant | Seeds | Transplanted | Fresh market | 2,178 to 9,680 | 36 to 72" | 18 to 40" | Florida | Santos et al. (2009) |

| Crop[1] | Propagation Material | Planting Method | End Use / Harvest Method[2] | Calculated Number of Seeds per Acre (Range) [3] | Row Width (inches) | In-Row Plant Spacing (inches) [4] | State | Reference |
|---|---|---|---|---|---|---|---|---|
| Eggplant | Seeds | Transplanted | Fresh market | 2,904 to 5,445 | 48 to 60" | 24 to 36" | New Jersey | Orton et al. (2010) |
| Eggplant | Seeds | Transplanted | Fresh market | 3,485 to 7,260 | 48 to 60" | 18 to 30" | Pennsylvania | Ernest et al. (2010) |
| Eggplant | Seeds | Transplanted (early planting) | Fresh market | 2,904 to 5,445 | 48 to 60" | 24 to 36" | Pennsylvania | Orzolek et al. (2009) |
| Eggplant | Seeds | Transplanted (late planting) | Fresh market | 3,485 to 7,260 | 48 to 60" | 18 to 30" | Pennsylvania | Orzolek et al. (2009) |
| Eggplant | Seeds / Transplants | Direct seeding / transplanted | Fresh market | 4,356 to 6,878 | 38 to 40" | 24 to 36" | Texas | Dainello (2003) |
| Eggplant | Transplants | Transplanted | Fresh market | 4,356 to 6,223 | 42 to 48" | 24 to 30" | Alabama | Kemble et al. (1998) |
| Eggplant | Transplants | Transplanted | Fresh market | 6,534 to 14,520 | 36 to 40" | 12 to 24" | California | Aguiar et al. (1998) |
| Eggplant | Transplants | Transplanted | Fresh market | 4,356 to 7,260 | 48 to 60" | 18 to 24" | New York | Reiners and Petzoldt (2010) |
| Eggplant | Transplants | Transplanted | Fresh market | 4,356 to 9,680 | 36 to 60" | 18 to 24" | Ohio | Precheur et al. (2010) |
| Eggplant | Transplants | Transplanted | Fresh market | 5,445 to 9,680 | 36 to 48" | 18 to 24" | Oregon | Oregon State University (2004) |
| Eggplant (Indian) | Seeds | Direct seeding | Fresh market | 2,178 to 9,680 | 36 to 72" | 18 to 40" | Florida | Lamberts et al. (2009) |
| Eggplant (Japanese) | Seeds | Direct seeding | Fresh market | 2,178 to 9,680 | 36 to 72" | 18 to 40" | Florida | Lamberts et al. (2009) |
| Eggplant (Thai) | Seeds | Direct seeding | Fresh market | 1,452 to 4,840 | 36 to 72" | 36 to 60" | Florida | Lamberts et al. (2009) |
| Endive | Seeds | Transplanted | Fresh market | 13,068 to 24,891 | 18 to 30" | 14 to 16" | Florida | Santos et al. (2009) |
| Endive | Seeds | Direct seeding | Fresh market | 26,136 to 52,272 | 12 to 15" | 10 to 16" | Indiana | Egel et al. (2010) |
| Endive | Seeds / Transplants | Direct seeding / Transplanted | Fresh market | 17,424 to 42,240 | 66 to 72" bed (with 3 to 4 rows) | 9 to 15" | Delaware | Ernest et al. (2010) |
| Endive / Escarole | Seeds | Direct seeding | Fresh market | 39,204 to 52,272 | 12 to 16 | 10" | Ohio | Precheur et al. (2010) |
| Endive / Escarole | Seeds / Transplants | Direct seeded / Transplanted | Fresh market | 29,040 to 41,818 | 15 to 18" | 10 to 12" | Oregon | Oregon State University (2002) |
| Endive / Escarole | Seeds / Transplants | Direct seeding / transplanted | Fresh market | 23,232 to 42,240 | 66 to 72" bed (with 3 to 4 rows) | 9 to 15" | Pennsylvania | Orzolek et al. (2009) |
| Endive / Escarole | Transplants | Transplanted | Fresh market | 49,005 to 65,340 | 16" | 6 to 8" | Ohio | Precheur et al. (2010) |
| Escarole | Seeds | Direct seeding | Fresh market | 13,068 to 24,891 | 18 to 30" | 14 to 16" | Florida | Santos et al. (2009) |
| Fennel | Seeds | Direct seeding | Fresh market | 58,080 | 18" | 6" | Multi-state | High Mowing Organic Seeds (2010) |
| Fennel | Seeds (pelleted) / transplanted | Direct seeding / Transplanted | Fresh market | 18,669 to 26,136 | 40 to 42" bed (with 2 rows) | 6 to 8" | California | USDA (2000) |
| Fennel | Transplants | Transplanted | Fresh market | 43,560 to 87,120 | 12 to 18" | 6 to 8" | Indiana | Egel et al. (2010) |
| Fenugreek | Seeds | Direct seeding | Fresh market | 232,320 to 348,480 | 9" | 2 to 3" | Florida | Lamberts et al. (2009) |
| Fescue, Red -- See Table 9 | | | | | | | | |
| Fescue, Tall -- See Table 9 | | | | | | | | |

| Crop[1] | Propagation Material | Planting Method | End Use / Harvest Method[2] | Calculated Number of Seeds per Acre (Range) [3] | Row Width (inches) | In-Row Plant Spacing (inches) [4] | State | Reference |
|---|---|---|---|---|---|---|---|---|
| Festulolium -- See Table 9 | | | | | | | | |
| Flax | Seeds | Direct seeding | Processing | 1,742,400 to 3,049,200 | | | North Dakota | Thomas Jefferson Agricultural Institute (undated) |
| Forest seedlings | Seeds | Direct seeding | Seedling production | 1,045,440 to 1,306,800 | | | Alabama | May (undated) |
| Gamagrass, Eastern -- See Table 9 | | | | | | | | |
| Garlic | Cloves | Direct planting | Fresh market | 348,480 to 392,040 | 16 to 18" | 4" apart in triple rows | Delaware | Ernest et al. (2010) |
| Garlic | Cloves | Direct planting | Fresh market | 348,480 to 392,040 | 16 to 18" beds (with four rows) | triple rows 4" apart on raised beds | New Jersey | Orton et al. (2010) |
| Garlic | Cloves | sets | Fresh market | 156,816 to 241,255 | 40" bed (with 2 rows) | 6 to 9 cloves / ft | Oregon | Oregon State University (2004) |
| Garlic | Cloves | Direct planting | Fresh market / processing | 261,360 to 295,879 | 16 to 18" bed (with 3 rows) | 4” | Pennsylvania | Orzolek et al. (2009) |
| Garlic | Cloves | sets | Fresh market | 78,408 to 110,046 | 38 to 40" bed (with 2 rows) | 3 to 4" | Texas | Dainello (2003) |
| Garlic (elephant) | Cloves | sets | Fresh market | 52,272 to 110,046 | 38 to 40" bed (with 2 rows) | 2 to 4 cloves / ft. | Texas | Dainello (2003) |
| Garlic, Great-headed (elephant) | Cloves | sets | Fresh market | 52,272 to 104,544 | 40" bed (with 2 rows) | 2 to 4 cloves / ft | Oregon | Oregon State University (2004) |
| Ginseng | Seeds | Direct seeding | Processing | 90 to 100 lb / A | | | California | British Columbia Ministry of Agriculture and Lands (2003) |
| Gourd, Edible | Seeds / Transplants | Direct seeding / transplanted | Fresh market | 4,356 to 7,260 | 48 to 60" | 18 to 24" | Michigan | Zandstra et al. (1986) |
| Gourd, Edible (angled luffa) | Seeds | Direct seeding | Fresh market | 1,452 to 2,904 | 60 to 72" | 36 to 60" | Florida | Lamberts et al. (2009) |
| Gourd, Edible (Cucurbita) | Seeds | Direct seeding | Fresh market | 1,361 to 3,630 | 72 to 96" | 24 to 48" | Georgia | Kelley and Langston (2009) |
| Gourd, Edible (Lagenaria) | Seeds | Direct seeding | Fresh market | 363 to 726 | 120 to 180" | 72 to 96" | Georgia | Kelley and Langston (2009) |
| Gourd, Edible (Long gourd) | Seeds | Direct seeding | Fresh market | 1,452 to 2,904 | 60 to 72" | 36 to 60" | Florida | Lamberts et al. (2009) |
| Gourd, Edible (Luffa) | Seeds | Direct seeding | Fresh market | 3,630 to 7,260 | 72 to 96" | 12 to 18" | Georgia | Kelley and Langston (2009) |
| Gourd, Edible (smooth luffa) | Seeds | Direct seeding | Fresh market | 1,452 to 2,904 | 60 to 72" | 36 to 60" | Florida | Lamberts et al. (2009) |
| Guar (Clusterbean) | Seeds | Direct seeding | Fresh market | 43,560 | 24" | 6" | Florida | Lamberts et al. (2009) |
| Horseradish | Root pieces | Direct planting | Fresh market / processing | 9,680 to 10,249 | 34 to 36" | 18" | Pennsylvania | Orzolek et al. (2009) |
| Indiangrass -- See Table 9 | | | | | | | | |
| Kale | Seeds | Direct seeding | Fresh market | 21,780 to 43,560 | 18 to 24" | 8 to 12" | Florida | Olson et al. (2009) |

| Crop[1] | Propagation Material | Planting Method | End Use / Harvest Method[2] | Calculated Number of Seeds per Acre (Range) [3] | Row Width (inches) | In-Row Plant Spacing (inches) [4] | State | Reference |
|---|---|---|---|---|---|---|---|---|
| Kale | Seeds | Direct Seeding | Fresh market | 288,000 to 576,000 | | | Ohio | Precheur et al. (2010) |
| Kale | Seeds | Direct seeding | Fresh market | 52,272 to 98,010 | 16 to 24" | 4 to 5" | Pennsylvania | Orzolek et al. (2009) |
| Kale | Seeds / Transplants | Direct seeded / Transplanted | Fresh market | 10,890 to 32,670 | 24 to 36" | 8 to 16" | Indiana | Egel et al. (2010) |
| Kale | Seeds | Direct seeding | Fresh market | 52,272 to 98,010 | 16 to 24" | 4 to 5" | New Jersey | Orton et al. (2010) |
| Kale (forage) -- See Table 9 | | | | | | | | |
| Kohlrabi | Transplants | Transplanted | Fresh market | 32,670 to 58,080 | 18 to 24" | 6 to 8" | New Jersey | Orton et al. (2010) |
| Kohlrabi | Transplants | Transplanted | Fresh market | 32,670 to 58,080 | 18 to 24" | 6 to 8" | Pennsylvania | Orzolek et al. (2009) |
| Leek | Transplants | Transplanted | Fresh market | 34,848 to 78,408 | 20 to 30" | 4 to 6" | Delaware | Ernest et al. (2010) |
| Leek | Transplants | Transplanted | Fresh market | 87,120 to 149,349 | 14 to 18" | 3 to 4" | Indiana | Egel et al. (2010) |
| Leek | Transplants | Transplanted | Fresh market | 34,848 to 78,408 | 20 to 30" | 4 to 6" | New Jersey | Orton et al. (2010) |
| Leek | Transplants | Transplanted | Fresh market | 78,408 to 130,680 | 16 to 20" | 3 to 4" | Ohio | Precheur et al. (2010) |
| Leek | Transplants | Transplanted | Fresh market | 43,560 to 87,120 | 18 to 24" | 4 to 6" | Oregon | Oregon State University (2002) |
| Leek | Transplants | Transplanted | Fresh market | 34,848 to 78,408 | 20 to 30" | 4 to 6" | Pennsylvania | Orzolek et al. (2009) |
| Lentil | Seeds | Direct seeding | Seeds | 40 to 70 lb / A | | 10 seeds / sq. ft | Montana | Cash et al. (1996) |
| Lentil | Seeds | Direct seeding | Processing | 522,720 | | 12 plants / sq. ft. | Saskatchewan | Saskatchewan Pulse Growers (2007) |
| Lespedeza, Annual (Korean) -- See Table 9 | | | | | | | | |
| Lespedeza, Annual (Striate) -- See Table 9 | | | | | | | | |
| Lespedeza, Sericea -- See Table 9 | | | | | | | | |
| Lettuce | Seeds | Direct seeding | Fresh market | 26,136 to 52,272 | 12 to 15" | 10 to 16" | Indiana | Egel et al. (2010) |
| Lettuce | Seeds (pelleted) | Direct seeding | Fresh market | 87,120 | 12" | 12 " (2 seeds) | Oregon | Oregon State University (2004) |
| Lettuce | Seeds / Transplants | Direct seeding / transplanted | Fresh market | 26,136 to 34,848 | 40" bed (with 2 rows) | 9 to 12" | Texas | Dainello (2003) |
| Lettuce | Transplants | Transplanted | Fresh market | 44,805 to 65,340 | 12 to 14" | 8 to 10" | Ohio | Precheur et al. (2010) |
| Lettuce | Transplants | Transplanted | Fresh market | 26,806to 40,731 | 14 to 18" | 11 to 13" | Oregon | Oregon State University (2004) |
| Lettuce, Bibb | Transplants | Transplanted | Fresh market | 116,160 to 174,240 | 9" | 4 to 6" | Ohio | Precheur et al. (2010) |
| Lettuce, Head | Seeds | Direct seeding | Fresh market | 149,349 to 313,632 (then thinned to stand) | 40 to 42" beds (with 2 rows) | 1 to 2" | Arizona | Kerns et al. (1999) |
| Lettuce, Head | Seeds | Direct seeding | Fresh market | 17,424 to 60,314 | 13 to 30" | 8 to 12" | Florida | Santos et al. (2009) |
| Lettuce, Head | Seeds / Transplants | Direct seeding / Transplanted | Fresh market | 17,424 to 21,780 | 24" | 12 to 15" | Delaware | Ernest et al. (2010) |
| Lettuce, Head | Seeds / Transplants | Direct seeding / transplanted | Fresh market | 24,891 to 17,424 | 30 to 42" (with 1 or 2 rows) | 12" | North Carolina | Sanders (2001) |

| Crop[1] | Propagation Material | Planting Method | End Use / Harvest Method[2] | Calculated Number of Seeds per Acre (Range) [3] | Row Width (inches) | In-Row Plant Spacing (inches) [4] | State | Reference |
|---|---|---|---|---|---|---|---|---|
| Lettuce, Head | Seeds / Transplants | Direct seeding / transplanted | Fresh market | 17,424 to 21,780 | 24" | 12 to 15" | Pennsylvania | Orzolek et al. (2009) |
| Lettuce, Head | Seeds (pelleted) | Direct seeding | Fresh market | 157,000 | Multiple rows on 42" bed | 2 to 3" | California | Jackson et al. (1997) |
| Lettuce, Leaf | Seeds (pelleted) | Direct seeding | Fresh market | 157,000 | Multiple rows on 42" bed | 2 to 3" | California | Jackson et al. (1997) |
| Lettuce, Leaf | Seeds / Transplants | Direct seeding / transplanted | Fresh market | 52,272 to 65,340 | 12" | 8 to 10" | North Carolina | Sanders (2001) |
| Lettuce, Leaf and Boston | Seeds / Transplants | Direct seeding / transplanted | Fresh market | 29,040 to 42,240 | 66 to 72" bed (with 3 to 4 rows) | 9 to 12" | Pennsylvania | Orzolek et al. (2009) |
| Lettuce, Leaf and Boston | Seeds / Transplants | Direct seeding / Transplanted | Fresh market | 21,780 to 42,240 | 66 to 72" bed (with 3 to 4 rows) | 9 to 12" | Delaware | Ernest et al. (2010) |
| Lettuce, Romaine | Seeds | Direct seeding | Fresh market | 17,424 to 40,209 | 13 to 30" | 12" | Florida | Santos et al. (2009) |
| Lupine, Blue | Seeds | Direct seeding | Feed and forage | 58 to 80 lb / A | | | California | UC SAREP Online Cover Crop Database (Undated) |
| Lupine, Narrow-leaf | Seeds | Direct seeding | Feed and forage | 80 to 150 lb / A | | | Oregon | Kettel et al. (2003) |
| Lupine, White | Seeds | Direct seeding | Feed and forage | 50 to160 lb / A | | | California | UC SAREP Online Cover Crop Database (Undated) |
| Lupine, Yellow | Seeds | Direct seeding | Feed and forage | 40 to 71 lb / A | | | California | UC SAREP Online Cover Crop Database (Undated) |
| Millet, Browntop | Seeds | Drill seeded | Feed | 10 to 20 lb / A | | | New Mexico | Baker (1993) |
| Millet, Finger | Seeds | Drill seeded | Feed | 8 to 10 lb / A | | | New Mexico | Baker (1993) |
| Millet, Foxtail | Seeds | Drill seeded | Feed | 10 to 20 lb / A | | | New Mexico | Baker (1993) |
| Millet, Japanese | Seeds | Drill seeded | Feed | 20 to 25 lb / A | | | New Mexico | Baker (1993) |
| Millet, Pearl | Seeds | Drill seeded | Feed | 5 to 15 lb / A | | | New Mexico | Baker (1993) |
| Millet, Pearl (forage) -- See Table 9 | | | | | | | | |
| Millet, Proso | Seeds | Drill seeded | Feed | 850,000 to 1,400,000 | | | Colorado | USDA (2003) |
| Millet, Proso | Seeds | Drill seeded | Feed | 20 to 30 lbs / A | 7" | | North Dakota | Berglund (2007) |
| Mint | Cuttings (3 to 4" stolons) | Transplanted | Processing (oil) | | 30 to 36" | not given | Indiana | Weller et al. (2000) |
| Mint | cutting | Transplanted | Processing | 10,000 roots / A | | | Idaho | USDA (2000) |
| Mint | cutting | Transplanted | Processing | 34,848 to 78,408 | 20 to 30" | 4 to 6" | Oregon | USDA (1999) |
| Muskmelon | Seeds | Direct seeding | Fresh market | 2,489 to 5,808 | 60 to 84" | 36 to 60"; 1 to 2 plants | Indiana | Egel et al. (2010) |

| Crop[1] | Propagation Material | Planting Method | End Use / Harvest Method[2] | Calculated Number of Seeds per Acre (Range) [3] | Row Width (inches) | In-Row Plant Spacing (inches) [4] | State | Reference |
|---|---|---|---|---|---|---|---|---|
| | | | | | | per hill | | |
| Muskmelon | Seeds | Direct seeding | Fresh market | 2,420 to 4,356 | 60 to 72" | 24 to 36" | New York | Reiners and Petzoldt (2010) |
| Muskmelon | Seeds | Direct seeding | Fresh market | 29,040 to 34,848 | 60 to 72" | 4 seeds / ft (thin to 18") | Oregon | Oregon State University (2004) |
| Muskmelon | Seeds / Transplants | direct seeded / transplanted | Fresh market | 3,630 to 5,808 | 60 to 72" | 18 to 24" | Alabama | Kemble (1996) |
| Muskmelon | Transplants | Transplanted | Fresh market | 1,815 to 2,904 | 60 to 72" | 36 to 48" | New Jersey | Orton et al. (2010) |
| Muskmelon | Transplants | Transplanted | Fresh market | 3,630 to 5,808 | 72 to 96" | 30 to 36" apart; 2 plants per hill | Ohio | Precheur et al. (2010) |
| Muskmelon | Transplants | Transplanted | Fresh market | 2,420 to 4,356 | 60 to 72" | 24 to 36" | Pennsylvania | Orzolek et al. (2009) |
| Muskmelon (Canteloupe) | Seeds | Direct seeding | Fresh market | 2,420 to 4,356 | 60 to 72" | 24 to 36" | Florida | Olson et al. (2010) |
| Muskmelon (Canteloupe) | Seeds | Direct seeding | Fresh market | 2,420 to 5,445 | 48 to 72" | 24 to 36" | Georgia | Boyhan et al. (2009) |
| Muskmelon (Canteloupe) | Seeds / Transplants | Direct seeding / transplanted | Fresh market | 6,534 to 10,052 | 78 to 80" | 8 to 12" | Texas | Dainello (2003) |
| Muskmelon (Canteloupe) | Seeds / Transplants | Direct seeding / transplanted | Fresh market | 6,534 to 13,403 | 78 to 80" (with two rows) | 12 to 24" | Texas | Dainello (2003) |
| Muskmelon (Honeydew) | Seeds / Transplants | Direct seeding / transplanted | Fresh market | 6,534 to 10,052 | 78 to 80" | 8 to 12" | Texas | Dainello (2003) |
| Muskmelon (Honeydew) | Seeds / Transplants | Direct seeding / transplanted | Fresh market | 6,534 to 13,403 | 78 to 80" (with two rows) | 12 to 24" | Texas | Dainello (2003) |
| Mustard Greens | Seeds | Direct Seeding | Fresh market | 4 to 6 lb / A | | | Ohio | Precheur et al. (2010) |
| Mustard Greens | Seeds | Direct seeding | Fresh market | 17,424 to 104,544 | 12 to 36" | 5 to 10" | Florida | Olson et al. (2009) |
| Mustard Greens | Seeds | Direct seeding | Fresh market | 43,560 to 130,680 | 12 to 24" | 4 to 6" | Oregon | Oregon State University (2002) |
| Mustard Greens | Seeds | Direct seeding | Fresh market | 3 to 4 lb / A | 16 to 24" | - | Pennsylvania | Orzolek et al. (2009) |
| Mustard Greens | Seeds / Transplants | Direct seeded / Transplanted | Fresh market | 29,040 to 52,272 | 12 to 18" | 10 to 12" | Indiana | Egel et al. (2010) |
| Mustard Greens (Chinese mustard) | Seeds | Direct seeding | Fresh market | 24,891 to 37,337 | 72" bed (with 4 rows) | 12 to 18" | Florida | Lamberts et al. (2009) |
| Mustard Greens (Chinese mustard) | Seeds | Direct seeding | Fresh market | 47,520 to 71,280 | 72" bed (with 4 rows) | 8 to 12" (shangai/cho y sum) | Florida | Lamberts et al. (2009) |
| Mustard Greens (Chinese mustard) | Seeds | Direct seeding | Fresh market | 57,024 to 95,040 | 72" bed (with 4 rows) | 6 to 10" baby bok choy | Florida | Lamberts et al. (2009) |
| Mustard Greens (Chinese mustard) | Seeds | Direct seeding | Fresh market | 142,560 to 285,120 | 72" bed (with 4 rows) | 2 to 4"u choy | Florida | Lamberts et al. (2009) |

| Crop[1] | Propagation Material | Planting Method | End Use / Harvest Method[2] | Calculated Number of Seeds per Acre (Range) [3] | Row Width (inches) | In-Row Plant Spacing (inches) [4] | State | Reference |
|---|---|---|---|---|---|---|---|---|
| Mustard Seed (Condiment mustard) | Seeds | Direct seeding | Processing | 5 to 7 lb / A | | | Oregon | Oregon State University (2002) |
| Oat | Seeds | Drill seeded | grain | 60 to 90 lb / A | | | South Dakota | Hall (2010) |
| Oats, spring (forage) -- See Table 9 | | | | | | | | |
| Okra | Seeds | Direct seeding | Fresh market | 11,616 to 21,780 | 24 to 36" | 12 to 15" | Alabama | Kemble et al. (1995) |
| Okra | Seeds | Precision Planting | Fresh market (hand harvested) | 17,424 to 40,209 | 26 to 40" | 6 to 9" | California | Aguiar and Mayberry (1997) |
| Okra | Seeds | Direct seeding | Fresh market | 10,454 to 43,560 | 36 to 60" | 4 to 10" | Florida | Santos et al. (2009) |
| Okra | Seeds | Direct seeding | Fresh market | 5,445 to 20,105 | 26 to 48" | 12 to 24" | Oregon | Oregon State University (2002) |
| Okra | Seeds | Direct seeding | Fresh market | 13,068 to 28,003 | 28 to 40" | 8 to 12" | Texas | Dainello (2003) |
| Okra | Seeds / Transplants | Direct Planting / Tranplanted | Fresh market | 14,520 to 21,780 | 24 to 36" | 12" | Alabama | Kemble et al. (1995) |
| Okra | Seeds / Transplants | Direct Planting / Tranplanted | Fresh market | 9,680 to 14,520 | 36" | 12 to 18" | Indiana | Egel et al. (2010) |
| Okra | Transplants | Transplanted | Fresh market (hand harvested) | 17,424 to 26,806 | 26 to 40" | 9" | California | Aguiar and Mayberry (1997) |
| Okra (dwarf varieties) | Seeds | Direct seeding | Fresh market | 9,957 to 12,446 | 42" | 12 to 15" | Delaware | Ernest et al. (2010) |
| Okra (dwarf varieties) | Seeds / Transplants | Direct Planting / Tranplanted | Fresh market | 9,957 to 12,446 | 42" | 12 to 15" | Pennsylvania | Orzolek et al. (2009) |
| Okra (medium and tall varieties) | Seeds | Direct seeding | Fresh market | 4,840 to 7,260 | 48 to 54" | 18 to 24" | Delaware | Orton et al. (2010) |
| Okra (medium and tall varieties) | Seeds / Transplants | Direct Planting / Tranplanted | Fresh market | 4,840 to 6,453 | 54" | 18 to 24" | Pennsylvania | Orzolek et al. (2009) |
| Onion | | | | | | | Washington | Refer to Oregon references below. |
| Onion | Seeds | Direct seeding | Processing (dehydrator) | 71,280 to 78,408 | 20 to 22" | 4" | California | Voss and Mayberry (1999) |
| Onion | Seeds | | Transplants | 174,240 | 6" | 6" | Delaware | Ernest et al. (2010) |
| Onion | Seeds | Direct seeding | Fresh market | 87,120 to 149,349 | 14 to 18" | 3 to 4" | Florida | Olson et al. (2009) |
| Onion | Seeds | Direct seeding | Fresh market | 448,046 | 14" | 12 seeds / ft | Indiana | Egel et al. (2010) |
| Onion | Seeds | Direct seeding | Fresh market / processing | 2 to 2.5 lb / A | | | Michigan | Zandstra et al. (1996) |
| Onion | Seeds | Direct seeding | Transplant production | 174,240 | 6" | 6" | New Jersey | Orton et al. (2010) |
| Onion | Seeds | Direct seeding | Set production | 55 to 75 lb / A | | | Oregon | Oregon State University (2002) |
| Onion | Seeds | Precision seeding (coated seeds) | Fresh market | 298,697 to 522,720 | 12 to 14" | 4 to 6 seeds / ft (2 lines) | Oregon, eastern | Oregon State University (2004) |

| Crop[1] | Propagation Material | Planting Method | End Use / Harvest Method[2] | Calculated Number of Seeds per Acre (Range) [3] | Row Width (inches) | In-Row Plant Spacing (inches) [4] | State | Reference |
|---|---|---|---|---|---|---|---|---|
| Onion | Seeds | Direct seeding | Fresh market | 522,720 to 1254,528 | 10 to 12" | 6 to 12 seeds / ft (2 lines) | Oregon, western | Oregon State University (2004) |
| Onion | Seeds | Direct seeding | Fresh market | 137,558 to 275,116 | 80" bed (with 5 to 7 rows) | 2 to 4 " | Texas | Dainello (2003) |
| Onion | Seeds | Direct seeding | Fresh market | 156,816 to 330,139 | 38 to 40" bed (with 2 to 4 rows) | 2 to 4 " | Texas | Dainello (2003) |
| Onion | Seeds / Transplants | Direct seeding / Transplanted | Fresh market | 522,720 to 784,080 | 40 to 42" bed (with rows 4" apart) | 2 to 3" | California | Voss and Mayberry (1999) |
| Onion | Sets | Transplanted | Fresh market | 174,240 to 201,046 | 24" | 8-9 sets/foot | Delaware | Ernest et al. (2010) |
| Onion | Sets | Transplanted | Fresh market | 65,340 to 139,392 | 15 to 24" | 3 to 4" | Oregon | Oregon State University (2004) |
| Onion | Sets | Transplanted | Fresh market / processing | 137,558 to 201,046 | 24" | 8 to 9 sets / ft | Pennsylvania | Orzolek et al. (2009) |
| Onion | Transplants | Transplanted | Fresh market | 58,080 to 112,011 | 14 to 18" | 4 to 6" | Florida | Olson et al. (2009) |
| Onion | Transplants | Transplanted | Fresh market | 112,011 | 14" | 4" | Indiana | Egel et al. (2010) |
| Onion | Transplants | Transplanted | Fresh market / processing | 65,340 to 139,392 | 15 to 24" | 3 to 4" | Michigan | Zandstra et al. (1996) |
| Onion (boiler) | Seeds | Direct seeding | Fresh market | 20 to 30 lb / A | | | Oregon | Oregon State University (2002) |
| Onion (dry bulb) | Seeds | Direct seeding | Fresh market | 3 to 4 lb / A | | | Ohio | Precheur et al. (2010) |
| Onion (dry bulb) | Sets | Direct planting | Fresh market | 174,240 to 201,046 | 24" | 8 to 9 sets / ft | New Jersey | Orton et al. (2010) |
| Onion (large Spanish) | Seeds | Direct seeding | Fresh market | 627,264 to 3136,320 | 4 to 5" | 0.5 to 2" | Delaware | Ernest et al. (2010) |
| Onion (large Spanish) | Sets | Direct planting | Fresh market | 836,352 to 3136,320 | 4 to 5" | .5 to 1.5" | New Jersey | Orton et al. (2010) |
| Onion (large Spanish) | Sets | Transplanted | Fresh market | 52,272 to 65,340 | 24" | 4 to 5" | Pennsylvania | Orzolek et al. (2009) |
| Onion (long-day) | Seeds | Direct seeding | Processing (Dehydrator) | 3 to 4 lb / A | | | Oregon | Oregon State University (2002) |
| Onion (pearl) | Seeds | Direct seeding | Fresh market / processing | 80 to 110 lb / A | | | Oregon | Oregon State University (2002) |
| Onion (seed) | Seeds | Direct seeding | Grown for Seed | 497,829 to 871,200 | 30 to 42" bed (with 2 rows) | 20 to 25 plants / ft | California | Voss et al. (1999) |
| Onion (seed) | Sets | Transplanted | Grown for Seed | 104,544 | 30" | 2" | California | Voss et al. (1999) |
| Onion (short day) | Transplants | Transplanted | Fresh market | 74,674 to 116,160 | 12 to 14" | 4.5 to 6" | Georgia | Boyhan and Kelley (2008) |
| Onion, Bunching | Seeds | Direct seeding | Fresh market | 261,360 to 1045,440 | 12 to 16" | 0.5 to 1.5" | Delaware | Ernest et al. (2010) |
| Onion, Bunching | Seeds | Direct seeding | Fresh market | 261,360 to 1045,440 | 12 to 16" | .5 to 1.5" | New Jersey | Orton et al. (2010) |
| Onion, Bunching | Seeds | Direct seeding | Fresh market | 261,360 to 1045,440 | 12 to 16" | 0.5 to 1.5" | Pennsylvania | Orzolek et al. (2009) |
| Onion, Bunching (green) | Seeds | Direct seeding | Fresh market | 1,045,440 to 1,229,929 | 30" | 60 to 70 seeds per foot | California | Voss and Mayberry (1999) |
| Onion, Bunching | Seeds | Direct seeding | Fresh market | 8 to 10 lb / A | | | Ohio | Precheur et al. (2010) |

| Crop[1] | Propagation Material | Planting Method | End Use / Harvest Method[2] | Calculated Number of Seeds per Acre (Range) [3] | Row Width (inches) | In-Row Plant Spacing (inches) [4] | State | Reference |
|---|---|---|---|---|---|---|---|---|
| (green) | | | | | | | | |
| Onion, Bunching (green) | Seeds | Direct seeding | Fresh market (early crop) | 10 to 25 lb / A | 12 to 15" | | Oregon | Oregon State University (2002) |
| Onion, Bunching (green) | Seeds | Direct seeding | Fresh market (late crop) | 6 to 8 lb / A | | | Oregon | Oregon State University (2002) |
| Orchardgrass -- See Table 9 | | | | | | | | |
| Parsely | Seeds | Transplanted | Fresh market | 52,272 to 104,544 | 15" | 4 to 8 | Indiana | Egel et al. (2010) |
| Parsely | Seeds | Direct seeding | Fresh market | 14 to 16 lb / A | | | Ohio | Precheur et al. (2010) |
| Parsely | Seeds | Direct seeding | Fresh market | 435,600 to 726,000 | 18" | 15 to 25 seeds/ft | Oregon | Oregon State University (2004) |
| Parsely | Seeds | Direct seeding | Fresh market | 20 to 40 lb / A | | | Pennsylvania | Orzolek et al. (2009) |
| Parsely | Seeds | Direct seeding | Fresh market | 1,254,528 to 1,568,160 | 40" bed (with 4 rows) | 24 to 30 seeds/ft | Texas | Dainello (2003) |
| Parsely | Transplants | Transplanted | Fresh market | 43,560 to 58,080 | 18" | 6 to 8" | Oregon | Oregon State University (2004) |
| Parsnip | Seeds | Direct seeding | Fresh market | 139,392 to 290,400 | 18 to 30" | 8 to 10 per row ft | Delaware | Ernest et al. (2010) |
| Parsnip | Seeds | Direct seeding | Fresh market | | 18 to 24" | not given | Indiana | Egel et al. (2010) |
| Parsnip | Seeds | Direct seeding | Fresh market | 139,392 to 290,400 | 18 to 30" | 8 to 10 plants / ft | New Jersey | Orton et al. (2010) |
| Parsnip | Seeds | Direct seeding | Fresh market | 232,320 to 435,600 | 12 to 18" | 8 to 10 plants / ft | Ohio | Precheur et al. (2010) |
| Parsnip | Seeds | Direct seeding | Fresh market | 87,120 to 174,240 | 18" | 2 to 4" | Oregon | Oregon State University (2003) |
| Parsnip | Seeds | Direct seeding | Fresh market | 139,392 to 290,400 | 18 to 30" | 8 to 10 plants / ft | Pennsylvania | Orzolek et al. (2009) |
| Parsnip | Seeds | Direct seeding | Fresh market | 116,160 to 174,240 | 18" | thin seedlings to 4 to 6" | Texas | Texas A & M University (2003?) |
| Pea, Edible-podded | Seeds | Direct seeding | Fresh market | 29,040 to 43,560 | 72" | 2 to 3" | California | Gaskell (1997) |
| Pea, Edible-podded | Seeds | Direct seeding | Fresh market | 29,040 to 87,120 | 36" | 2 to 6" | Florida | Olson et al. (2009) |
| Pea, Edible-podded | Seeds | Direct seeding | Fresh market | 87,120 to 174,240 | 30 to 36" (hand harvest) | 1.2 to 2" | Florida | Lamberts et al. (2009) |
| Pea, Edible-podded | Seeds | Direct seeding | Fresh market | 313,632 to 653,400 | 8 to 10" (machine harvested) | 1.2 to 2" | Florida | Lamberts et al. (2009) |
| Pea, Edible-podded | Seeds | Direct seeding | Fresh market | 43,560 to 52,272 | 60 to 72" | 2" | Oregon | Oregon State University (2003) |
| Pea, Edible-podded | Seeds | Direct seeding | Processing (machine harvest) | 392,040 to 522,720 | 6 to 8" | 2" | Oregon | Oregon State University (2003) |

| Crop[1] | Propagation Material | Planting Method | End Use / Harvest Method[2] | Calculated Number of Seeds per Acre (Range) [3] | Row Width (inches) | In-Row Plant Spacing (inches) [4] | State | Reference |
|---|---|---|---|---|---|---|---|---|
| Pea, Field | Seeds | Direct seeding | Processing | 304,920 to 348,480 | | | North Dakota | Schatz and Endres (2003) |
| Pea, Field | Seeds | Direct seeding | Processing | 80 to 200 lb / A | | | Montana | Cash et al. (1995) |
| Pea, Garden | Seeds | Direct seeding | Fresh market | 80 to 120 lb / A | | | Deleware | Ernest et al. (2010) |
| Pea, Garden | Seeds | | Processing | 250 to 275 lb / A | 30" | 6 to 8 | Deleware | Ernest et al. (2010) |
| Pea, Garden | Seeds | Direct seeding | Fresh market | 87,120 to 108,900 | 32 to 36" | 18 to 20 plants / yd | New York | USDA (1999) |
| Pea, Garden | Seeds | Direct seeding | Processing | 398,263 to 560,057 | 7" | 16 to 22 plants / yd | New York | USDA (1999) |
| Pea, Garden | Seeds | Direct seeding | Fresh market / processing | 87,120 to 174,240 | 24 to 36" | 1.5 to 2" | Ohio | Precheur et al. (2010) |
| Pea, Garden | Seeds | Drill seeded | Processing | 196,020 to 522,720 | 6 to 8" | 2 to 4" | Oregon | Oregon State University (2003) |
| Pea, Garden | Seeds | Direct seeding | Fresh market | 80 to 120 lb / A | | | Pennsylvania | Orzolek et al. (2009) |
| Pea, Garden | Seeds | Direct seeding | Processing | 250 to 275 lb / A | | | Pennsylvania | Orzolek et al. (2009) |
| Pea, Pigeon | Seeds | Direct seeding | Fresh market | 4,840 to 10,890 | 24 to 36" | 24 to 36" | Florida | Lamberts et al. (2009) |
| Pea, Pigeon | Seeds | Direct seeding | Fresh market | 39,204 to 52,272 | 40" | 3 to 4" | Texas | Texas A & M University (2003) |
| Pea, Southern | Seeds | Direct seeding | Fresh market | 24,891 to 104,544 | 20 to 42" | 3 to 6" | Florida | Olson et al. (2009) |
| Pea, Southern (cowpea) | Seeds | Direct seeding | Seeds | 87,120 to 139,392 | 30 to 36" | 6 to 8 seeds/foot | Deleware | Ernest et al. (2010) |
| Pea, Southern (cowpea) | Seeds | Direct seeding | Seeds | 24,891 to 87,120 | 36 to 42" | 2 to 6" apart | Texas | Dainello (2003) |
| Peanut | Seeds | Direct seeding | Processing | 70,000 to 105,000 | | | Minnesota | Putnam et al. (1991) |
| Peanut | Seeds | Drill seeded | Processing | 43,560 to 72,600 | 36" | 3 to 5 seeds/ft | North Carolina | Bradley and Pearce (2004) |
| Peanut | Seeds | Direct seeding | Fresh market / processing | 29,040 to 87,120 | 36" | 2 to 6" | Virginia | Faircloth and Shokes (2009) |
| Peanut | Seeds | Direct seeding | Fresh market / processing | 107 to 170 lb / A | | | Multi-state | Jordan et al. (2000) |
| Peppers | Seeds | | Fresh market | 5,808 to 10,890 | 48 to 60" | 12 to 18" | Delaware | Ernest et al. (2010) |
| Peppers | Transplants | Transplanted | Fresh market | 5,445 to 14,520 | 36 to 48" | 12 to 24" | Florida | Olson et al. (2009) |
| Peppers | Transplants | Transplanted | Fresh market | 14,520 to 17,424 | 60 to 72" beds (with 2 rows) | 12" | Indiana | Egel et al. (2010) |
| Peppers | Transplants | Transplanted | Fresh market | 10,000 | | | Michigan | Zandstra et al. (1985) |
| Peppers | Transplants | Transplanted (double row) | Fresh market | 2,308 to 2,967 | 151" | 14 to 18" | New York | Reiners and Petzoldt (2010) |
| Peppers | Transplants | Transplanted (single row) | Fresh market | 8,712 to 10,890 | 48 to 60" | 12" | New York | Reiners and Petzoldt (2010) |

| Crop[1] | Propagation Material | Planting Method | End Use / Harvest Method[2] | Calculated Number of Seeds per Acre (Range) [3] | Row Width (inches) | In-Row Plant Spacing (inches) [4] | State | Reference |
|---|---|---|---|---|---|---|---|---|
| Peppers | Transplants | Transplanted | Fresh market | 7,260 to 14,520 | 36 to 48" | 12 to 18" | Ohio | Precheur et al. (2010) |
| Peppers | Transplants | Transplanted | Fresh market / processing | 9,680 to 29,040 | 18 to 36" | 12 to 18" | Oregon | Oregon State University (2004) |
| Peppers | Transplants | Transplanted | Fresh market | 5,808 to 10,890 | 48 to 60" | 12 to 18" | Pennsylvania | Orzolek et al. (2009) |
| Peppers (Bell) | Seeds / Transplants | Direct seeding / transplanted | Fresh market | 26,136 to 69,696 | 30 to 40" (with 1 or 2 rows) | 6 to 12" | Texas | Dainello (2003) |
| Peppers (chili) | Seeds | Direct seeding | Fresh market / processing | 10,890 to 26,136 | 60 to 72" bed (with 1 or 2 rows) | 8 to 16" | California | Smith et al. (1998) |
| Peppers (Hot and Paprika) | Seeds | Direct seeding | Fresh market / processing | 4 lb / A or greater | | | New Mexico | Walker (2004) |
| Peppers, Bell | Seeds / Transplants | Direct seeding / transplanted | Fresh market | 5,445 to 26,136 | 30 to 72" | 8 to 16" | California | Hartz et al. (2008) |
| Peppers, Bell | Transplants | Transplanted | Fresh market | 14,520 to 17,424 | 60 to 72" bed (with 2 rows) | 12" | Georgia | Kelley and Boyham (2009) |
| Peppers, Hot | Seeds / Transplants | Direct seeding / transplanted | Fresh market | 52,272 to 209,088 | 30 to 40" (with 1 or 2 beds) | 2 to 6" | Texas | Dainello (2003) |
| Peppers, Hot (bird's eye) | Seeds | Direct seeding | Fresh market | 5,445 to 17,424 | 36 to 48" | 10 to 24" | Florida | Lamberts et al. (2009) |
| Potato | Seed potatoes | Direct planting | Fresh market | 14,935 to 34,848 | 36 to 42" | 5 to 10" | Florida | Olson et al. (2009) |
| Potato | Seed potatoes | Direct seeding | Fresh market / processing | 14,520 to 26,356 | 34 to 36" | 7 to 12" | Pennsylvania | Orzolek et al. (2009) |
| Potato | Seed piece | Direct planting | Fresh market / processing | 2,100 to 2,700 lbs / A | | | Idaho | Patterson (2007) |
| Potato | Seed piece | Direct planting | Fresh market / processing | 15,681 to 26,356 | 34 to 40" | 7 to 10" | Texas | Masabni and Lillard (Undated) |
| Pumpkin | Seeds | Direct seeding | Fresh market (Jack-O-Lantern) | 871 to 2,420 | 72 to 120" | 36 to 60" | California | Gaskell and Smith (1997) |
| Pumpkin | Seeds | Direct seeding | Fresh market (minipumpkins) | 3,630 to 7,260 | 36 to 48" | 24 to 36" | California | Gaskell and Smith (1997) |
| Pumpkin | Seeds | Direct seeding | Processing | 3,630 to 7,260 | 36 to 48" | 24 to 36" | California | Gaskell and Smith (1997) |
| Pumpkin | Seeds | Direct seeding | Fresh market | 968 to 2,904 | 60 to 108" | 36 to 60" | Florida | Olson et al. (2010) |
| Pumpkin (bush type) | Seeds | Direct seeding | Fresh market / processing | 2,042 to 5,445 | 60 to 96" | 3 to 5 plants/96" | Georgia | Kelley and Langston (2009) |
| Pumpkin (bush type) | Seeds | Direct seeding | Fresh market / processing | 3,630 to 7,260 | 48 to 72" | 18 to 24" | New York | Reiners and Petzoldt (2010) |

| Crop[1] | Propagation Material | Planting Method | End Use / Harvest Method[2] | Calculated Number of Seeds per Acre (Range) [3] | Row Width (inches) | In-Row Plant Spacing (inches) [4] | State | Reference |
|---|---|---|---|---|---|---|---|---|
| Pumpkin (large vine type) | Seeds / Transplants | Direct seeding / transplanted | Fresh market | 2,178 to 3,630 | 96 to 120" | 18 to 24" | Texas | Dainello (2003) |
| Pumpkin (semi-bush / vine type) | Seeds | Direct seeding | Fresh market / processing | 1,361 to 2,042 | 96" | 2 to 3 plants/8ft | Georgia | Kelley and Langston (2009) |
| Pumpkin (small vine type) | Seeds / Transplants | Direct seeding / transplanted | Fresh market | 3,267 to 4,356 | 80" | 18 to 24" | Texas | Dainello (2003) |
| Pumpkin (vine type) | Seeds | Direct seeding | Fresh market / processing | 908 to 1,361 | 96 to 144" | 2 plants/ 8 row ft | Georgia | Kelley and Langston (2009) |
| Pumpkin (vine type) | Seeds | Direct seeding | Fresh market / processing | 1,815 to 3,630 | 72 to 96" | 24 to 36" | New York | Reiners and Petzoldt (2010) |
| Pumpkin / Winter Squash (bush or short vine) | Seeds | Direct seeding | Fresh market | 2,904 to 7,260 | 36 to 60" | 24 to 36" | Alabama | Kemble et al. (2000) |
| Pumpkin / Winter Squash (bush or short vine) | Seeds | Direct seeding | Fresh market / processing | 1,742 to 7,260 | 36 to 60" | 24 to 36" | Oregon | Oregon State University (2004) |
| Pumpkin / Winter Squash (large vine with large fruit ) | Seeds | Direct seeding | Fresh market | 605 to 871 | 120 to 144" | 60 to 72" | New Jersey | Orton et al. (2010) |
| Pumpkin / Winter Squash (large vine with large fruit) | Seeds | Direct seeding | Fresh market | 1,089 to 2,420 | 72 to 96" | 36 to 60" | Alabama | Kemble et al. (2000) |
| Pumpkin / Winter Squash (large vine with large fruit) | Seeds | Direct seeding | Fresh market / processing | 1,089 to 1,815 | 72 to 96" | 48 to 60" | Oregon | Oregon State University (2004) |
| Pumpkin / Winter Squash (large vine with small fruit) | Seeds | Direct seeding | Fresh market | 1,089 to 2,420 | 72 to 96" | 36 to 60" | Alabama | Kemble et al. (2000) |
| Pumpkin / Winter Squash (large vine with small fruit) | Seeds | Direct seeding | Fresh market / processing | 1,361 to 2,420 | 72 to 96" | 36 to 48" | Oregon | Oregon State University (2004) |
| Pumpkin / Winter Squash (large vines with fruits over 30 lbs) | Seeds | Direct seeding | Fresh market | 589 to 871 | 120 to 144" | 60 to 74" | Pennsylvania | Orzolek et al. (2009) |
| Pumpkin / Winter Squash (large/medium vines with fruits 8 to 15 lbs) | Seeds | Direct seeding | Fresh market | 1,675 to 2,904 | 60 to 78" | 36 to 48" | Pennsylvania | Orzolek et al. (2009) |
| Pumpkin / Winter Squash (medium vine with large fruit) | Seeds | Direct seeding | Fresh market | 1,210 to 1,452 | 90 to 108" | 48" | New Jersey | Orton et al. (2010) |

| Crop[1] | Propagation Material | Planting Method | End Use / Harvest Method[2] | Calculated Number of Seeds per Acre (Range) [3] | Row Width (inches) | In-Row Plant Spacing (inches) [4] | State | Reference |
|---|---|---|---|---|---|---|---|---|
| Pumpkin / Winter Squash (medium vine with medium fruit) | Seeds | Direct seeding | Fresh market | 1,452 to 2,420 | 72 to 90" | 36 to 48" | New Jersey | Orton et al. (2010) |
| Pumpkin / Winter Squash (small vine with small fruit) | Seeds | Direct seeding | Fresh market | 3,630 to 4,356 | 60 to 72" | 24" | New Jersey | Orton et al. (2010) |
| Pumpkins / Winter Squash | Seeds | Direct seeding | Fresh market / Processing | 2,723 to 7,260 | 72 to 96" | 12 to 24" | Ohio (Midwest region) | Precheur et al. (2010) |
| Pumpkins / Winter Squash (large vines with fruits over 12 to 25 lbs) | Seeds | Direct seeding | Fresh market | 1,210 to 1,420 | 92 to 108" | 48" | Pennsylvania | Orzolek et al. (2009) |
| Pumpkins / Winter Squash (small/bush vines with fruits less than 8 lbs) | Seeds | Direct seeding | Fresh market | 3,734 to 4,356 | 60 to 70" | 24" | Pennsylvania | Orzolek et al. (2009) |
| Radish | Seeds | Direct seeding | Fresh market | 1,045,440 | 6" | 1 inch | Florida | Ozores-Hampton et al. (2009) |
| Radish | Seeds | Direct seeding | Fresh market | 418,176 to 522,720 | 15" | 12 to 15 seeds /ft | Indiana | Egel et al. (2010) |
| Radish | Seeds | Direct seeding | Fresh market | 418,176 to 980,100 | 8 to 15" | 0.8 to 1" | Pennsylvania | Orzolek et al. (2009) |
| Radish, Oriental (Daikon) | Seeds | Direct seeding | Fresh market | 63,360 to 95,040 | 72" bed (3 or 4 rows 11" apart) | 6 to 9" | Florida | Lamberts et al. (2009) |
| Rape (Canola) | Seeds | Drill seeded | Processing | 5 lb / A | | | Multi-state | Monsanto (2006) |
| Rape (Canola) | Seeds | Direct seeding | Processing | 696,960 to 740,520 | | | North Dakota | North Dakota State University (2009) |
| Rape (Canola) | Seeds | Direct seeding | Processing | 435,600 to 696,960 | | | Oregon and Idaho | Brown et al. (2008) |
| Rape (forage) -- See Table 9 | | | | | | | | |
| Rhubarb | Crowns | Direct planting | Fresh market (hand harvested) | 3,630 to 3,630 | 72" | 24" | California | Schrader (2000) |
| Rhubarb | Crowns | Direct planting | Fresh market (mechanical harvesting) | 7,260 to 7,260 | 48" | 18" | California | Schrader (2000) |
| Rhubarb | Crowns | Transplanted | Fresh market | 2,420 to 2,904 | 60 to 72" | 36" | Indiana | Egel et al. (2010) |
| Rhubarb | Crowns | Direct planting | Fresh market | 2,420 to 5,445 | 48 to 72" | 24 to 36" | Oregon | Oregon State University (2004) |
| Rice -- See Table 8 | | | | | | | | |
| Rutabaga | Seeds | Direct seeding | Fresh market | 1.5 to 2 lb / A | | | Pennsylvania | Orzolek et al. (2009) |
| Rye | Seeds | Drill seeded | Feed, Forage | 60 to 90 lb / A | 6 to 7" | | Minnesota | Oelke et al. (1990) |
| Rye, winter (forage) -- See Table 9 | | | | | | | | |
| Ryegrass, Annual -- See Table 9 | | | | | | | | |

| Crop[1] | Propagation Material | Planting Method | End Use / Harvest Method[2] | Calculated Number of Seeds per Acre (Range) [3] | Row Width (inches) | In-Row Plant Spacing (inches) [4] | State | Reference |
|---|---|---|---|---|---|---|---|---|
| Ryegrass, Perennial -- See Table 9 | | | | | | | | |
| Safflower | Seeds | Direct seeding | Processing | 20 to 25 lb / A | | | Nebraska | Lyon et al. (2007) |
| Safflower | Seeds | Direct seeding | Processing | 20 to 30 lb / A | | | Oregon | Armah-Agyeman et al. (2002) |
| Safflower | Seeds | Direct seeding | Processing | 15 to 30 lb / A | | | North Dakota | Berglund et al. (2007) |
| Safflower (dryland) | Seeds | Direct seeding | Processing | 30 to 35 lb / A | | | Washington | Agriculture and Agri-Food Canada (2004) |
| Salsify and Scorzonera | Seeds | Direct seeding | Fresh market | 209,088 to 627,264 | 10 to 15" | 1 to 2" | Oregon | Oregon State University (2003) |
| Sesame | Seeds | Direct seeding | Processing | 104,544 to 316,800 | 30" | 6 to 18 seedlings / ft | Missouri | Thomas Jefferson Agricultural Institute (Undated) |
| Sesame | Seeds | Drill / broadcase | Forage (doves) | 5 to 12 lb / A | | | Florida | Giuliano et al. (2009) |
| Shallot | Sets | Direct planting | Fresh market | 65,340 to 116,160 | 18 to 24" | 3 to 4 bulbs / ft | Oregon | Oregon State University (2003) |
| Snakegourd | Seeds | Direct seeding | Fresh market | 1,452 to 2,904 | 60 to 72" | 36 to 60" | Florida | Lamberts et al. (2009) |
| Sorghum (forage) -- See Table 9 | | | | | | | | |
| Sorghum, grain | Seeds | Drill seeded | Feed | 45,000 to 100,000 | | | Arkansas | University of Arkansas Cooperative Extension Service (undated) |
| Sorghum-sudangrass (forage) -- See Table 9 | | | | | | | | |
| Soybean, Vegetable (Edamane) | Seeds | Direct seeding | Fresh market | 43,560 to 156,816 | 20 to 24" | 2 to 6" | Florida | Lamberts et al. (2009) |
| Soybeans -- See Table 5 | | | | | | | | |
| Spinach | Seeds | Direct seeding | Fresh market | 9 to 25 lb / A | | | California | LeStrange et al. (1997) |
| Spinach | Seeds | Direct seeding | Processing | 10 to 14 lb / A | 12" (processing) | | Delaware | Ernest et al. (2010) |
| Spinach | Seeds | Direct seeding | Fresh market | | | | Delaware | Ernest et al. (2010) |
| Spinach | Seeds | Direct seeding | Fresh market | 29,040 to 261,360 | 12 to 36" | 2 to 6" | Florida | Olson et al. (2009) |
| Spinach | Seeds | Direct seeding | Fresh market | 116,160 to 261,360 | 12 to 18" | 4 to 6 plants / ft | Indiana | Egel et al. (2010) |
| Spinach | Seeds | Direct seeding | Fresh market | 10 to 14 lb / A | | | New Jersey | Orton et al. (2010) |
| Spinach | Seeds | Direct seeding | Processing | 18 to 25 lb / A | | | New Jersey | Orton et al. (2010) |
| Spinach | Seeds | Direct seeding | Fresh market | 174,240 to 348,480 | 12 to 18" | 6 to 8 plants/ft | New York | Reiners and Petzoldt (2010) |
| Spinach | Seeds | Direct seeding | Processing | 435,600 to 653,400 | 12" | 10 to 15 plants/ft | New York | Reiners and Petzoldt (2010) |
| Spinach | Seeds | Direct seeding | Fresh market | 196,020 to 348,480 | 12 to 16" | 6 to 8 plants/ft | Ohio | Precheur et al. (2010) |
| Spinach | Seeds | Direct seeding | Fresh market / | 10 to 15 lb / A (non- | | | Oregon | Oregon State University |

| Crop[1] | Propagation Material | Planting Method | End Use / Harvest Method[2] | Calculated Number of Seeds per Acre (Range) [3] | Row Width (inches) | In-Row Plant Spacing (inches) [4] | State | Reference |
|---|---|---|---|---|---|---|---|---|
| | | (non-precision) | processing | precision planter) | | | | (2003) |
| Spinach | Seeds | Direct seeding (precision) | Fresh market / processing | 3 to 4 lb / A (precision planter) | | | Oregon | Oregon State University (2003) |
| Spinach | Seeds | Direct seeding | Fresh market | 10 to 14 lb / A | | | Pennsylvania | Orzolek et al. (2009) |
| Spinach | Seeds | Direct seeding | Processing | 18 to 25 lb / A | | | Pennsylvania | Orzolek et al. (2009) |
| Squash (bush type) | Seeds | Direct seeding | Fresh market | 5,445 to 14,520 | 36 to 48" | 12 to 24" | Florida | Olson et al. (2010) |
| Squash (bush type) | Seeds | Direct seeding | Fresh market / processing | 3,630 to 7,260 | 48 to 72" | 18 to 24" | New York | Reiners and Petzoldt (2010) |
| Squash (bush type) | Seeds / Transplants | Direct seeding / transplanted | Fresh market | 4,356 to 15,374 | 34 to 40" | 12 to 36" | Texas | Dainello (2003) |
| Squash (vine type) | Seeds | Direct seeding | Fresh market | 968 to 2,904 | 60 to 108" | 36 to 60" | Florida | Olson et al. (2010) |
| Squash (vine type) | Seeds | Direct seeding | Fresh market / processing | 1,815 to 3,630 | 72 to 96" | 24 to 36" | New York | Reiners and Petzoldt (2010) |
| Squash (vine type) | Seeds / Transplants | Direct seeding / transplanted | Fresh market | 1,452 to 7,260 | 72 to 120" | 12 to 36" | Texas | Dainello (2003) |
| Squash, Summer | Seeds | Direct seeding | Fresh market | 5,445 to 9,680 | 36 to 48" | 18 to 24" | Alabama | Kemble et al. (2005) |
| Squash, Summer | Seeds | Direct seeding | Fresh market | 8,712 to 11,616 | 60" | 9 to 12" | California | Molinar et al. (1999) |
| Squash, Summer | Seeds | Direct seeding | Fresh market | 2,420 to 4,356 | 60 to 72" | 24 to 36" | Delaware | Ernest et al. (2010) |
| Squash, Summer | Seeds | Direct seeding | Fresh market | 4,356 to 9,680 | 36 to 40" | 18 to 36" | Oregon | Oregon State University (2004) |
| Squash, Summer | Seeds / Transplants | Direct seeding / transplanted | Fresh market | 4,356 to 7,260 | 48 to 60" | 18 to 24" | Michigan | Zandstra et al. (1986) |
| Squash, Summer | Seeds / Transplants | Direct seeding / transplanted | Fresh market | 2,420 to 4,356 | 60 to 72" | 24 to 36" | New Jersey | Orton et al. (2010) |
| Squash, Summer | Transplants | Transplanted | Fresh market | 2,420 to 4,356 | 60 to 72" | 24 to 36" | Pennsylvania | Orzolek et al. (2009) |
| Squash, Summer (bush type) | Seeds | Direct seeding | Fresh market | 4,356 to 7,260 | 48 to 60" | 18 to 24" | Ohio | Precheur et al. (2010) |
| Squash, Summer (vine type) | Seeds | Direct seeding | Fresh market | 2,722 to 7,260 | 72 to 96" | 12 to 24" | Ohio | Precheur et al. (2010) |
| Squash, Winter (bush type) | Seeds / Transplants | Direct seeding / transplanted | Fresh market | 4,356 to 7,260 | 48 to 60" | 18 to 24" | Michigan | Zandstra et al. (1986) |
| Squash, Winter (spaghetti) | Seeds | Direct seeding | Fresh market | 2,723 | 96" | 2 seeds every 48" | Texas | Texas A & M University (2003?) |
| Strawberry | Plugs (runner tips) | Transplanted | Fresh market / processing | 26,136 to 29,040 | 36 to 40"bed (2 rows) | 12" | Delaware | Ernest et al. (2010) |
| Strawberry | Plugs (runner tips) | Transplanted | Fresh market | 6,534 to 10,890 | 48 to 60" | 12 to 16" | Florida | Peres et al. (2009) |
| Strawberry | Plugs (runner tips) | Transplanted | Fresh market / processing | 26,136 to 29,040 | 36 to 40"bed (2 rows) | 12" | New Jersey | Orton et al. (2010) |

| Crop[1] | Propagation Material | Planting Method | End Use / Harvest Method[2] | Calculated Number of Seeds per Acre (Range) [3] | Row Width (inches) | In-Row Plant Spacing (inches) [4] | State | Reference |
|---|---|---|---|---|---|---|---|---|
| Strawberry | Plugs (runner tips) | Transplanted | Fresh market / processing | 4,356 to 7,260 | 48" | 18 to 30" | Pennsylvania | Orzolek et al. (2009) |
| Sudangrass -- See Table 9 | | | | | | | | |
| Sugar beets | Seeds | Direct seeding | Processing | 34,848 to 71,280 | 22 to 30" | 4 to 6" | Multi-state | Holly Hybrids and SESVanderHave (Undated) |
| Sugar beets | Seeds | Direct seeding | Processing | 1.25 lb treated seed / A | | | Washington | Washington State University Cooperative Extension. (2001) |
| Sugar beets | Seeds | Direct seeding | Processing | 52,272 to 104,544 | 30" or 40" (with two rows) | 3 to 4 " | California | Mayberry (2000) |
| Sugar beets | Seeds | Direct seeding | Processing | 55,000 seeds / A | | | Colorado | USDA (2003) |
| Sugar beets | Seeds | Direct seeding | Seed Production | 174,240 to 217,800 | 24" | 8 to 10 seeds / ft | Oregon | Oregon State University (Undated) |
| Sugar beets | Seeds | Direct seeding | Seed Production | 348,480 to 435,600 | 18" | 12 to 15 seeds / ft | Oregon | Oregon State University (Undated) |
| Sugar beets | Seeds | Direct seeding | Processing | 30,000 to 40,000 | 18 to 24" | | Minnesota | Cattanach et al. (1991) |
| Sunflower | Seeds | Drill seeded | Processing (non-oil) | 4 lb / A | | | Minnesota | Putnam et al. (1990) |
| Sunflower | Seeds | Drill seeded | Processing (oil) | 3 lb / A | | | Wisconsin | Putnam et al. (1990) |
| Swede (forage) -- See Table 9 | | | | | | | | |
| Sweet potato | Slips / cuttings | Transplanted | Fresh market | 8,712 to 18,669 | 42 to 48" | 8 to 15" | Alabama | Kemble et al. (2006) |
| Sweet potato | Slips / cuttings | Transplanted | Fresh market | 11,880 to 18,341 | 38 to 44" | 9 to 12" | California | May and Scheuerman (1998) |
| Sweet potato | Slips / cuttings | Transplanted | Fresh market | 5,445 | 48" | 24" | Florida | Lamberts and Olson (2009) |
| Sweet potato | Slips / cuttings | Transplanted | Fresh market | 10,890 to 17,424 | 36 to 48" | 10 to 12" | Florida | Olson et al. (2009) |
| Sweet potato | Slips / cuttings | Direct planting | Fresh market | 9,680 to 17,424 | 30 to 36" | 12 to 18" | New Jersey | Orton et al. (2010) |
| Sweet potato | Slips / cuttings | Transplanted | Fresh market | 12,446 to 14,520 | 36 to 42" | 12" | Oklahoma | Motes and Criswell (Undated) |
| Sweet potato | Slips / cuttings | Direct planting | Fresh market | 8,712 to 12,446 | 42 to 48" | 12 to 15" | Oregon | Oregon State University (2003) |
| Sweet potato | Slips / cuttings | Transplanted | Fresh market | 9,680 to 17,424 | 30 to 36" | 12 to 18" | Pennsylvania | Orzolek et al. (2009) |
| Sweet potato | Slips / cuttings | Transplanted | Fresh market | 10,668 to 20,634 | 38 to 42" | 8 to 14" | Texas | Dainello (2003) |
| Turnip Greens | Seeds | Direct Seeding | Fresh market | 4 to 6 lb / A | | | Ohio | Precheur et al. (2010) |
| Sweetclover -- See Table 9 | | | | | | | | |
| Swiss Chard | Seeds | Direct Seeding | Fresh market | 13,068 to 17,424 | 40" | 9 to 12" | California | Schrader and Mayberry (2003) |
| Swiss Chard | Seeds | Direct seeding | Fresh market | 196,020 to 348,480 | 12 to 16" | 1.5 to 2" | Ohio | Precheur et al. (2010) |
| Swiss Chard | Seeds | Direct seeding | Fresh market | 87,120 to 174,240 | 24 to 36" | 6 to 8 seeds / ft (thin to 6 to 12") | Texas | Dainello (2003) |

| Crop[1] | Propagation Material | Planting Method | End Use / Harvest Method[2] | Calculated Number of Seeds per Acre (Range) [3] | Row Width (inches) | In-Row Plant Spacing (inches) [4] | State | Reference |
|---|---|---|---|---|---|---|---|---|
| Swiss Chard | Seeds | Precision planting | Fresh market | 52,272 to 82,535 | 38 to 40" bed (2 rows) | 4 to 6" | Texas | Dainello (2003) |
| Swiss Chard | Transplants | Transplanted | Fresh market | 14,520 to 43,560 | 24 to 36" | 6 to 12" | Texas | Dainello (2003) |
| Switchgrass -- See Table 9 | | | | | | | | |
| Taro | Transplants (corm) | Transplanted | Fresh market | 5,445 | 48" | 24" | Florida | Lamberts and Olson (2009) |
| Teff -- See Table 9 | | | | | | | | |
| Timothy -- See Table 9 | | | | | | | | |
| Tobacco (burley) | Transplants | Transplanted | Processing | 5,445 to 9,334 | 42 to 48" | 16 to 24" | Virginia | Peek et al. (2008) |
| Tomatillo | Seeds / Transplants | Direct seeding / transplanted | Fresh market | 9,680 to 9,680 | 36" | 18" | Texas | Texas A & M University (2003) |
| Tomatillo | Transplants | Transplanted | Fresh market | 7,920 to 26,136 | 30 to 66"bed (with 1 or 2 rows) | 16 to 24" | California | Smith et al. (1999) |
| Tomatillos | Transplants | Transplanted | Fresh market | 3,485 | 60" | 30" | Oregon | Oregon State University (2003) |
| Tomato | Seeds | Direct seeding | Processing | 52,272 to 69,696 | 60" bed (with 1 or 2 rows) | 9 to 12" (clump of 2 or 3 plants) | California | Hartz et al. (2008) |
| Tomato | Seeds | Direct seeding | Processing | 87,120 to 130,680 | 60 to 72" (with two rows) | 8 to 10" (clump of 3 to 5 plants) | Ohio | Precheur et al. (2010) |
| Tomato | Seeds | Direct seeding | Fresh market | 26,136 to 43,560 | 48 to 60" | 9 to 12" (with 1 to 3 seeds/hill) | Oregon | Oregon State University (2003) |
| Tomato | Seeds | Direct Seeding | Processing | 3,630 to 4,840 | 72" | 18 to 24" | Texas | Dainello (2003) |
| Tomato | Transplants | Transplanted | Fresh market | 3,630 to 7,260 | 48 to 72" | 18 to 24" | Alabama | Kemble et al. (2000) |
| Tomato | Transplants | Transplanted | Fresh market | 4,356 to 6,150 | 60 to 72" | 17 to 20" | California | LeStrange et al. (2000) |
| Tomato | Transplants | Transplanted | Processing | 7,000 to 9,000 | | | California | Hartz et al. (2008) |
| Tomato | Transplants | Transplanted | Fresh market | 2,723 to 10,890 | 48 to 72" | 12 to 32" | Florida | Olson et al. (2009) |
| Tomato | Transplants | Transplanted | Processing | 9,680 to 17,424 | 60 to 72" (with two rows) | 12 to 18" | Ohio | Precheur et al. (2010) |
| Tomato | Transplants | Transplanted | Fresh market | 2,178 to 10,890 | 48 to 60" | 12 to 48" | Oregon | Oregon State University (2003) |
| Tomato | Transplants | Transplanted | Fresh market | 3,630 to 4,840 | 72" | 18 to 24" | Texas | Dainello (2003) |
| Tomato (determinate) | Seeds | Direct seeding | Fresh market | 4,356 to 8,712 | 48 to 60" | 15 to 24" | Delaware | Ernest et al. (2010) |
| Tomato (determinate) | Transplants | Transplanted | Fresh market | 4,356 to 8,712 | 48 to 60" | 15 to 24" | New Jersey | Orton et al. (2010) |
| Tomato (determinate) | Transplants | Transplanted | Fresh market | 4,356 to 8,712 | 48 to 60" | 15 to 24" | New York | Reiners and Petzoldt (2010) |
| Tomato (determinate) | Transplants | Transplanted | Fresh market | 4,356 to 9,680 | 36 to 60" | 18 to 24" | Ohio | Precheur et al. (2010) |

| Crop[1] | Propagation Material | Planting Method | End Use / Harvest Method[2] | Calculated Number of Seeds per Acre (Range) [3] | Row Width (inches) | In-Row Plant Spacing (inches) [4] | State | Reference |
|---|---|---|---|---|---|---|---|---|
| Tomato (determinate) | Transplants | Transplanted | Fresh market | 4,356 to 8,712 | 48 to 60" | 15 to 24" | Pennsylvania | Orzolek et al. (2009) |
| Tomato (indeterminate) | Seeds | Direct seeding | Fresh market | 2,420 to 4,356 | 60 to 72" | 24 to 36" | Delaware | Ernest et al. (2010) |
| Tomato (indeterminate) | Transplants | Transplanted | Fresh market | 3,630 to 5,808 | 60 to 72" | 18 to 24" | New Jersey | Orton et al. (2010) |
| Tomato (indeterminate) | Transplants | Transplanted | Fresh market | 2,904 to 4,356 | 60 to 72" | 24 to 36" | New York | Reiners and Petzoldt (2010) |
| Tomato (indeterminate) | Transplants | Transplanted | Fresh market | 2,904 to 5,227 | 60 to 72" | 20 to 30" | Ohio | Precheur et al. (2010) |
| Tomato (indeterminate) | Transplants | Transplanted | Fresh market | 2,420 to 4,356 | 60 to 72" | 24 to 36" | Pennsylvania | Orzolek et al. (2009) |
| Tomato (trellis) | Transplants | Transplanted | Fresh market | 4,356 to 5,808 | 60" | 18 to 24" | New York | Reiners and Petzoldt (2010) |
| Triticale -- See Table 9 | | | | | | | | |
| Turnip | Seeds | Direct seeding | Fresh market | 29,040 to 261,360 | 12 to 36" | 2 to 6" | Florida | Olson et al. (2009) |
| Turnip | Seeds | Direct seeding | | 116,160 to 224,023 | 14 to 18" | 2 to 3" | Indiana | Egel et al. (2010) |
| Turnip | Seeds | Direct seeding | Fresh market | 116,160 to 224,023 | 14 to 18" | 2 to 3" | Pennsylvania | Orzolek et al. (2009) |
| Turnip (forage) – See Table 9 | | | | | | | | |
| Turnip greens | Seeds | Direct seeding | Fresh market | 3 to 4 lb / A | | | Pennsylvania | Orzolek et al. (2009) |
| Turnip Greens | Seeds / Transplants | Direct seeded / Transplanted | Fresh market | 130,680 to 1,045,440 | 6 to 12" | 1 to 4" | Indiana | Egel et al. (2010) |
| Vetch, Hairy -- See Table 9 | | | | | | | | |
| Watermelon | Seeds | Direct seeding | Fresh market | 1,361 to 2,420 | 72 to 96" | 36 to 48" | Delaware | Ernest et al. (2010) |
| Watermelon | Seeds | Direct seeding | Fresh market | 807 to 4,356 | 60 to 108" | 24 to 72" | Florida | Olson et al. (2010) |
| Watermelon | Seeds | Direct seeding | Fresh market | 605 to 2,420 | 72 to 144" | 36 to 72"; 1 plant per hill | Indiana | Egel et al. (2010) |
| Watermelon | Seeds | Direct seeding | Fresh market | 1,361 to 2,420 | 72 to 96" | 36 to 48" | New York | Reiners and Petzoldt (2010) |
| Watermelon | Seeds / Transplants | Direct seeding / transplanted | Fresh market | 1,361 to 2,420 | 72 to 96" | 36 to 48" | New Jersey | Orton et al. (2010) |
| Watermelon | Seeds / Transplants | Direct seeded / Transplanted | Fresh market | 21,780 to 43,560 | 72 to 144" | 6 seeds / ft (thin to 12 to 36") | Oregon | Oregon State University (2004) |
| Watermelon | Seeds / Transplants | Direct seeded / Transplanted | Fresh market | 1,556 to 2,420 | 72 to 84" | 36 to 48" | Pennsylvania | Orzolek et al. (2009) |
| Watermelon | Transplants | Transplanted | Fresh market | 2,178 to 3,267 | 80" | 24 to 36" | California | Baameur et al. (2009) |
| Watermelon | Transplants | Transplanted | Fresh market | 2,420 to 4,840 | 72 to 108" | 36 to 48"; 2 plants/hill | Ohio | Precheur et al. (2010) |
| Watermelon | Seeds / Transplants | Direct seeded / Transplanted | Fresh market | 871 to 1,089 | 96 to 120" (dryland) | 60" (dryland) | Texas | Dainello (2003) |
| Watermelon | Seeds / Transplants | Direct seeded / Transplanted | Fresh market | 2,178 | 80" (irrigated) | 36" (irrigated) | Texas | Dainello (2003) |

| Crop[1] | Propagation Material | Planting Method | End Use / Harvest Method[2] | Calculated Number of Seeds per Acre (Range) [3] | Row Width (inches) | In-Row Plant Spacing (inches) [4] | State | Reference |
|---|---|---|---|---|---|---|---|---|
| Watermelon (mini) | Seeds / Transplants | Direct seeding / Transplanted | Fresh market | 2,178 to 4,840 | 72 to 120" | 18 to 24" | Indiana | Egel et al. (2010) |
| Watermelon (seedless) | Transplants | Transplanted | Fresh market | 2,178 to 3,267 | 80" | 24 to 36" | Texas | Dainello (2003) |
| Wheat – See Table 7 | | | | | | | | |
| Wheat, Winter (forage) -- See Table 9 | | | | | | | | |
| Yautia (Tannia) | Transplants (corm) | Transplanted | Fresh market | 5,445 | 48" | 24" | Florida | Lamberts and Olson (2009) |

**Footnotes:**

[1] Crop names follow that given in Markle et al. (1998).

[2] End use / harvest method. End use listed in reference or the most common end use if not listed. Other end uses may occur as well. Harvest method is noted when it affects seeding rates.

[3] Calculated number of seeds per acre is equal to 43,560 sq. feet per acre * 144 sq. inches per sq. foot * row width (inches)$^{-1}$ * in-row plant spacing (inches)$^{-1}$. In some cases, references do not report the row width and in-row spacing, but rather the number of pounds of seed planted per acre because adequate information is not available in the reference. No adjustments were made based on germination rate.

[4] In-row plant spacing. Depending on the reference, spacing may be reported as distance between seeds (transplants) or the number of seeds planted per row foot. All values are converted to distance between seeds to calculate number of seeds per acre.

Blank cells indicate no information available**.**

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## APPENDIX A.

Table A-1. Calculation of number of seeds per acre, based on the row width and distance between seeds within the row. Calculated number of seeds per acre is equal to 43,560 sq. feet per acre * 144 sq. inches per sq. foot * row width (inches)$^{-1}$ * in-row plant spacing (inches) $^{-1}$.

| Row Width (inches) | Distance between seeds in row (inches) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 2 | 3,136,320 | 1,568,160 | 1,045,440 | 784,080 | 627,264 | 522,720 | 448,046 | 392,040 | 348,480 |
| 3 | 2,090,880 | 1,045,440 | 696,960 | 522,720 | 418,176 | 348,480 | 298,697 | 261,360 | 232,320 |
| 4 | 1,568,160 | 784,080 | 522,720 | 392,040 | 313,632 | 261,360 | 224,023 | 196,020 | 174,240 |
| 5 | 1,254,528 | 627,264 | 418,176 | 313,632 | 250,906 | 209,088 | 179,218 | 156,816 | 139,392 |
| 6 | 1,045,440 | 522,720 | 348,480 | 261,360 | 209,088 | 174,240 | 149,349 | 130,680 | 116,160 |
| 7 | 896,091 | 448,046 | 298,697 | 224,023 | 179,218 | 149,349 | 128,013 | 112,011 | 99,566 |
| 8 | 784,080 | 392,040 | 261,360 | 196,020 | 156,816 | 130,680 | 112,011 | 98,010 | 87,120 |
| 9 | 696,960 | 348,480 | 232,320 | 174,240 | 139,392 | 116,160 | 99,566 | 87,120 | 77,440 |
| 10 | 627,264 | 313,632 | 209,088 | 156,816 | 125,453 | 104,544 | 89,609 | 78,408 | 69,696 |
| 11 | 570,240 | 285,120 | 190,080 | 142,560 | 114,048 | 95,040 | 81,463 | 71,280 | 63,360 |
| 12 | 522,720 | 261,360 | 174,240 | 130,680 | 104,544 | 87,120 | 74,674 | 65,340 | 58,080 |
| 13 | 482,511 | 241,255 | 160,837 | 120,628 | 96,502 | 80,418 | 68,930 | 60,314 | 53,612 |
| 14 | 448,046 | 224,023 | 149,349 | 112,011 | 89,609 | 74,674 | 64,007 | 56,006 | 49,783 |
| 15 | 418,176 | 209,088 | 139,392 | 104,544 | 83,635 | 69,696 | 59,739 | 52,272 | 46,464 |
| 16 | 392,040 | 196,020 | 130,680 | 98,010 | 78,408 | 65,340 | 56,006 | 49,005 | 43,560 |
| 17 | 368,979 | 184,489 | 122,993 | 92,245 | 73,796 | 61,496 | 52,711 | 46,122 | 40,998 |
| 18 | 348,480 | 174,240 | 116,160 | 87,120 | 69,696 | 58,080 | 49,783 | 43,560 | 38,720 |
| 19 | 330,139 | 165,069 | 110,046 | 82,535 | 66,028 | 55,023 | 47,163 | 41,267 | 36,682 |
| 20 | 313,632 | 156,816 | 104,544 | 78,408 | 62,726 | 52,272 | 44,805 | 39,204 | 34,848 |
| 21 | 298,697 | 149,349 | 99,566 | 74,674 | 59,739 | 49,783 | 42,671 | 37,337 | 33,189 |
| 22 | 285,120 | 142,560 | 95,040 | 71,280 | 57,024 | 47,520 | 40,731 | 35,640 | 31,680 |
| 23 | 272,723 | 136,362 | 90,908 | 68,181 | 54,545 | 45,454 | 38,960 | 34,090 | 30,303 |
| 24 | 261,360 | 130,680 | 87,120 | 65,340 | 52,272 | 43,560 | 37,337 | 32,670 | 29,040 |
| 25 | 250,906 | 125,453 | 83,635 | 62,726 | 50,181 | 41,818 | 35,844 | 31,363 | 27,878 |
| 26 | 241,255 | 120,628 | 80,418 | 60,314 | 48,251 | 40,209 | 34,465 | 30,157 | 26,806 |
| 27 | 232,320 | 116,160 | 77,440 | 58,080 | 46,464 | 38,720 | 33,189 | 29,040 | 25,813 |
| 28 | 224,023 | 112,011 | 74,674 | 56,006 | 44,805 | 37,337 | 32,003 | 28,003 | 24,891 |
| 29 | 216,298 | 108,149 | 72,099 | 54,074 | 43,260 | 36,050 | 30,900 | 27,037 | 24,033 |
| 30 | 209,088 | 104,544 | 69,696 | 52,272 | 41,818 | 34,848 | 29,870 | 26,136 | 23,232 |
| 31 | 202,343 | 101,172 | 67,448 | 50,586 | 40,469 | 33,724 | 28,906 | 25,293 | 22,483 |
| 32 | 196,020 | 98,010 | 65,340 | 49,005 | 39,204 | 32,670 | 28,003 | 24,503 | 21,780 |
| 33 | 190,080 | 95,040 | 63,360 | 47,520 | 38,016 | 31,680 | 27,154 | 23,760 | 21,120 |
| 34 | 184,489 | 92,245 | 61,496 | 46,122 | 36,898 | 30,748 | 26,356 | 23,061 | 20,499 |
| 35 | 179,218 | 89,609 | 59,739 | 44,805 | 35,844 | 29,870 | 25,603 | 22,402 | 19,913 |
| 36 | 174,240 | 87,120 | 58,080 | 43,560 | 34,848 | 29,040 | 24,891 | 21,780 | 19,360 |
| 37 | 169,531 | 84,765 | 56,510 | 42,383 | 33,906 | 28,255 | 24,219 | 21,191 | 18,837 |
| 38 | 165,069 | 82,535 | 55,023 | 41,267 | 33,014 | 27,512 | 23,581 | 20,634 | 18,341 |
| 39 | 160,837 | 80,418 | 53,612 | 40,209 | 32,167 | 26,806 | 22,977 | 20,105 | 17,871 |
| 40 | 156,816 | 78,408 | 52,272 | 39,204 | 31,363 | 26,136 | 22,402 | 19,602 | 17,424 |
| 41 | 152,991 | 76,496 | 50,997 | 38,248 | 30,598 | 25,499 | 21,856 | 19,124 | 16,999 |
| 42 | 149,349 | 74,674 | 49,783 | 37,337 | 29,870 | 24,891 | 21,336 | 18,669 | 16,594 |
| 43 | 145,875 | 72,938 | 48,625 | 36,469 | 29,175 | 24,313 | 20,839 | 18,234 | 16,208 |

| Row Width (inches) | Distance between seeds in row (inches) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 44 | 142,560 | 71,280 | 47,520 | 35,640 | 28,512 | 23,760 | 20,366 | 17,820 | 15,840 |
| 45 | 139,392 | 69,696 | 46,464 | 34,848 | 27,878 | 23,232 | 19,913 | 17,424 | 15,488 |
| 46 | 136,362 | 68,181 | 45,454 | 34,090 | 27,272 | 22,727 | 19,480 | 17,045 | 15,151 |
| 47 | 133,460 | 66,730 | 44,487 | 33,365 | 26,692 | 22,243 | 19,066 | 16,683 | 14,829 |
| 48 | 130,680 | 65,340 | 43,560 | 32,670 | 26,136 | 21,780 | 18,669 | 16,335 | 14,520 |
| 49 | 128,013 | 64,007 | 42,671 | 32,003 | 25,603 | 21,336 | 18,288 | 16,002 | 14,224 |
| 50 | 125,453 | 62,726 | 41,818 | 31,363 | 25,091 | 20,909 | 17,922 | 15,682 | 13,939 |
| 51 | 122,993 | 61,496 | 40,998 | 30,748 | 24,599 | 20,499 | 17,570 | 15,374 | 13,666 |
| 52 | 120,628 | 60,314 | 40,209 | 30,157 | 24,126 | 20,105 | 17,233 | 15,078 | 13,403 |
| 53 | 118,352 | 59,176 | 39,451 | 29,588 | 23,670 | 19,725 | 16,907 | 14,794 | 13,150 |
| 54 | 116,160 | 58,080 | 38,720 | 29,040 | 23,232 | 19,360 | 16,594 | 14,520 | 12,907 |
| 55 | 114,048 | 57,024 | 38,016 | 28,512 | 22,810 | 19,008 | 16,293 | 14,256 | 12,672 |
| 56 | 112,011 | 56,006 | 37,337 | 28,003 | 22,402 | 18,669 | 16,002 | 14,001 | 12,446 |
| 57 | 110,046 | 55,023 | 36,682 | 27,512 | 22,009 | 18,341 | 15,721 | 13,756 | 12,227 |
| 58 | 108,149 | 54,074 | 36,050 | 27,037 | 21,630 | 18,025 | 15,450 | 13,519 | 12,017 |
| 59 | 106,316 | 53,158 | 35,439 | 26,579 | 21,263 | 17,719 | 15,188 | 13,289 | 11,813 |
| 60 | 104,544 | 52,272 | 34,848 | 26,136 | 20,909 | 17,424 | 14,935 | 13,068 | 11,616 |

Table A-1. Continued.

| Row Width (inches) | Distance between seeds in row (inches) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 10 | 11 | 12 | 18 | 24 | 30 | 36 | 42 | 48 |
| 2 | 313,632 | 285,120 | 261,360 | 174,240 | 130,680 | 104,544 | 87,120 | 74,674 | 65,340 |
| 3 | 209,088 | 190,080 | 174,240 | 116,160 | 87,120 | 69,696 | 58,080 | 49,783 | 43,560 |
| 4 | 156,816 | 142,560 | 130,680 | 87,120 | 65,340 | 52,272 | 43,560 | 37,337 | 32,670 |
| 5 | 125,453 | 114,048 | 104,544 | 69,696 | 52,272 | 41,818 | 34,848 | 29,870 | 26,136 |
| 6 | 104,544 | 95,040 | 87,120 | 58,080 | 43,560 | 34,848 | 29,040 | 24,891 | 21,780 |
| 7 | 89,609 | 81,463 | 74,674 | 49,783 | 37,337 | 29,870 | 24,891 | 21,336 | 18,669 |
| 8 | 78,408 | 71,280 | 65,340 | 43,560 | 32,670 | 26,136 | 21,780 | 18,669 | 16,335 |
| 9 | 69,696 | 63,360 | 58,080 | 38,720 | 29,040 | 23,232 | 19,360 | 16,594 | 14,520 |
| 10 | 62,726 | 57,024 | 52,272 | 34,848 | 26,136 | 20,909 | 17,424 | 14,935 | 13,068 |
| 11 | 57,024 | 51,840 | 47,520 | 31,680 | 23,760 | 19,008 | 15,840 | 13,577 | 11,880 |
| 12 | 52,272 | 47,520 | 43,560 | 29,040 | 21,780 | 17,424 | 14,520 | 12,446 | 10,890 |
| 13 | 48,251 | 43,865 | 40,209 | 26,806 | 20,105 | 16,084 | 13,403 | 11,488 | 10,052 |
| 14 | 44,805 | 40,731 | 37,337 | 24,891 | 18,669 | 14,935 | 12,446 | 10,668 | 9,334 |
| 15 | 41,818 | 38,016 | 34,848 | 23,232 | 17,424 | 13,939 | 11,616 | 9,957 | 8,712 |
| 16 | 39,204 | 35,640 | 32,670 | 21,780 | 16,335 | 13,068 | 10,890 | 9,334 | 8,168 |
| 17 | 36,898 | 33,544 | 30,748 | 20,499 | 15,374 | 12,299 | 10,249 | 8,785 | 7,687 |
| 18 | 34,848 | 31,680 | 29,040 | 19,360 | 14,520 | 11,616 | 9,680 | 8,297 | 7,260 |
| 19 | 33,014 | 30,013 | 27,512 | 18,341 | 13,756 | 11,005 | 9,171 | 7,860 | 6,878 |
| 20 | 31,363 | 28,512 | 26,136 | 17,424 | 13,068 | 10,454 | 8,712 | 7,467 | 6,534 |
| 21 | 29,870 | 27,154 | 24,891 | 16,594 | 12,446 | 9,957 | 8,297 | 7,112 | 6,223 |
| 22 | 28,512 | 25,920 | 23,760 | 15,840 | 11,880 | 9,504 | 7,920 | 6,789 | 5,940 |
| 23 | 27,272 | 24,793 | 22,727 | 15,151 | 11,363 | 9,091 | 7,576 | 6,493 | 5,682 |
| 24 | 26,136 | 23,760 | 21,780 | 14,520 | 10,890 | 8,712 | 7,260 | 6,223 | 5,445 |
| 25 | 25,091 | 22,810 | 20,909 | 13,939 | 10,454 | 8,364 | 6,970 | 5,974 | 5,227 |
| 26 | 24,126 | 21,932 | 20,105 | 13,403 | 10,052 | 8,042 | 6,702 | 5,744 | 5,026 |
| 27 | 23,232 | 21,120 | 19,360 | 12,907 | 9,680 | 7,744 | 6,453 | 5,531 | 4,840 |
| 28 | 22,402 | 20,366 | 18,669 | 12,446 | 9,334 | 7,467 | 6,223 | 5,334 | 4,667 |
| 29 | 21,630 | 19,663 | 18,025 | 12,017 | 9,012 | 7,210 | 6,008 | 5,150 | 4,506 |
| 30 | 20,909 | 19,008 | 17,424 | 11,616 | 8,712 | 6,970 | 5,808 | 4,978 | 4,356 |
| 31 | 20,234 | 18,395 | 16,862 | 11,241 | 8,431 | 6,745 | 5,621 | 4,818 | 4,215 |
| 32 | 19,602 | 17,820 | 16,335 | 10,890 | 8,168 | 6,534 | 5,445 | 4,667 | 4,084 |
| 33 | 19,008 | 17,280 | 15,840 | 10,560 | 7,920 | 6,336 | 5,280 | 4,526 | 3,960 |
| 34 | 18,449 | 16,772 | 15,374 | 10,249 | 7,687 | 6,150 | 5,125 | 4,393 | 3,844 |
| 35 | 17,922 | 16,293 | 14,935 | 9,957 | 7,467 | 5,974 | 4,978 | 4,267 | 3,734 |
| 36 | 17,424 | 15,840 | 14,520 | 9,680 | 7,260 | 5,808 | 4,840 | 4,149 | 3,630 |
| 37 | 16,953 | 15,412 | 14,128 | 9,418 | 7,064 | 5,651 | 4,709 | 4,036 | 3,532 |
| 38 | 16,507 | 15,006 | 13,756 | 9,171 | 6,878 | 5,502 | 4,585 | 3,930 | 3,439 |
| 39 | 16,084 | 14,622 | 13,403 | 8,935 | 6,702 | 5,361 | 4,468 | 3,829 | 3,351 |
| 40 | 15,682 | 14,256 | 13,068 | 8,712 | 6,534 | 5,227 | 4,356 | 3,734 | 3,267 |
| 41 | 15,299 | 13,908 | 12,749 | 8,500 | 6,375 | 5,100 | 4,250 | 3,643 | 3,187 |
| 42 | 14,935 | 13,577 | 12,446 | 8,297 | 6,223 | 4,978 | 4,149 | 3,556 | 3,111 |
| 43 | 14,588 | 13,261 | 12,156 | 8,104 | 6,078 | 4,863 | 4,052 | 3,473 | 3,039 |
| 44 | 14,256 | 12,960 | 11,880 | 7,920 | 5,940 | 4,752 | 3,960 | 3,394 | 2,970 |
| 45 | 13,939 | 12,672 | 11,616 | 7,744 | 5,808 | 4,646 | 3,872 | 3,319 | 2,904 |
| 46 | 13,636 | 12,397 | 11,363 | 7,576 | 5,682 | 4,545 | 3,788 | 3,247 | 2,841 |
| 47 | 13,346 | 12,133 | 11,122 | 7,414 | 5,561 | 4,449 | 3,707 | 3,178 | 2,780 |

| Row Width (inches) | Distance between seeds in row (inches) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 10 | 11 | 12 | 18 | 24 | 30 | 36 | 42 | 48 |
| 48 | 13,068 | 11,880 | 10,890 | 7,260 | 5,445 | 4,356 | 3,630 | 3,111 | 2,723 |
| 49 | 12,801 | 11,638 | 10,668 | 7,112 | 5,334 | 4,267 | 3,556 | 3,048 | 2,667 |
| 50 | 12,545 | 11,405 | 10,454 | 6,970 | 5,227 | 4,182 | 3,485 | 2,987 | 2,614 |
| 51 | 12,299 | 11,181 | 10,249 | 6,833 | 5,125 | 4,100 | 3,416 | 2,928 | 2,562 |
| 52 | 12,063 | 10,966 | 10,052 | 6,702 | 5,026 | 4,021 | 3,351 | 2,872 | 2,513 |
| 53 | 11,835 | 10,759 | 9,863 | 6,575 | 4,931 | 3,945 | 3,288 | 2,818 | 2,466 |
| 54 | 11,616 | 10,560 | 9,680 | 6,453 | 4,840 | 3,872 | 3,227 | 2,766 | 2,420 |
| 55 | 11,405 | 10,368 | 9,504 | 6,336 | 4,752 | 3,802 | 3,168 | 2,715 | 2,376 |
| 56 | 11,201 | 10,183 | 9,334 | 6,223 | 4,667 | 3,734 | 3,111 | 2,667 | 2,334 |
| 57 | 11,005 | 10,004 | 9,171 | 6,114 | 4,585 | 3,668 | 3,057 | 2,620 | 2,293 |
| 58 | 10,815 | 9,832 | 9,012 | 6,008 | 4,506 | 3,605 | 3,004 | 2,575 | 2,253 |
| 59 | 10,632 | 9,665 | 8,860 | 5,906 | 4,430 | 3,544 | 2,953 | 2,531 | 2,215 |
| 60 | 10,454 | 9,504 | 8,712 | 5,808 | 4,356 | 3,485 | 2,904 | 2,489 | 2,178 |

APPENDIX B.

Table B-1. Seed Counts per Pound for Crops requested by EFED.

| Crop Common Name | Seeds Per Pound | Reference | Link |
|---|---|---|---|
| Alfalfa | 199,000 to 227,000 | Buckley (2002)<br>Pennington (2010) | http://www.co.morton.nd.us/vertical/Sites/%7B90CBB59C-38EA-4D41-861A-81C9DEBD6022%7D/uploads/%7B09494A1C-6D80-497B-86CD-559B2126BC3C%7D.PDF<br>http://www.penningtonseed.com/ |
| Barley (2 row) | 9,400 to 10,000 | Peel (2001) | http://www.ext.nodak.edu/extnews/newsrelease/2001/031501/06seedin.htm |
| Barley (6 row) | 13,000 to 14,000 | Peel (2001) | http://www.ext.nodak.edu/extnews/newsrelease/2001/031501/06seedin.htm |
| Bean, Dry common | 800 to 1,814 | Dainello (2003)<br>Canadian Food Inspection Agency (2010) | http://aggie-horticulture.tamu.edu/extension/vegetable/cropguides/<br>http://www.inspection.gc.ca/english/plaveg/seesem/abce.shtml |
| Bean, lima | 907 | Canadian Food Inspection Agency (2010) | http://www.inspection.gc.ca/english/plaveg/seesem/abce.shtml |
| Bean, Succulent common | 960 to 2,400 | Mclaurin and Granberry (2009) | http://pubs.caes.uga.edu/caespubs/pubcd/C626/C626.htm |
| Bermudagrass (hulled) | 2,071,000 | Pennington (2010) | http://www.penningtonseed.com/ |
| Bluegrass, Kentucky | 1,440,000 | Pennington (2010) | http://www.penningtonseed.com/ |
| Broccoli | 80,000 to 150,000 | Green Harvest Australia (2010) | http://www.greenharvest.com.au/seeds/info_sheet/seeds_per_gram.html |
| Brussels sprouts | 64,000 to 192,000 | Zandstra, et al. (1988) | http://web2.msue.msu.edu/bulletins/Bulletin/PDF/E1591.pdf |
| Buffalograss | 42,000 | Bamert Seed (2010) | http://www.bamertseed.com/seeds.html |
| Cabbage | 45,000 to 165,000 | Green Harvest Australia (2010) | http://www.greenharvest.com.au/seeds/info_sheet/seeds_per_gram.html |
| Canola, see rape | | | |
| Carrot | 175,000 to 400,000 | Nunez, et al. (2008) | http://www.ucanr.org/freepubs/docs/7226.pdf |
| Cauliflower | 80,000 to 150,000 | Green Harvest Australia (2010) | http://www.greenharvest.com.au/seeds/info_sheet/seeds_per_gram.html |
| Celery | 1,000,000 to 1,152,000 | Dainello (2003)<br>Osborne Seed Company (2010) | http://aggie-horticulture.tamu.edu/extension/vegetable/cropguides/<br>http://www.osborneseed.com/seedcount.cfm?top=no&seedchart=yes&show=no |
| Corn (popcorn) | 1,361 to 4,760 | Canadian Food Inspection Agency (2010)<br>Carter et al. (1989) | http://www.inspection.gc.ca/english/plaveg/seesem/abce.shtml<br>http://www.hort.purdue.edu/newcrop/afcm/popcorn.html |
| Corn (sweetcorn) | 1,800 to 4,500 | Smith, et al. (1997) | http://www.ucanr.org/freepubs/docs/7223.pdf |
| Corn, field | 1,361 to 2,000 | Osborne Seed Company (2010)<br>Canadian Food Inspection Agency (2010) | http://www.osborneseed.com/seedcount.cfm?top=no&seedchart=yes&show=no<br>http://www.inspection.gc.ca/english/plaveg/seesem/abce.shtml |
| Cotton | 4,500 | Verhalen, et al. (Undated) | http://pods.dasnr.okstate.edu/docushare/dsweb/Get/Document-2593/CR-2118.pdf |
| Cucumber | 12,000 to 18,144 | Oregon State University (2002-2004)<br>Canadian Food Inspection Agency (2010) | http://nwrec.hort.oregonstate.edu/vegindex.html<br>http://www.inspection.gc.ca/english/plaveg/seesem/abce.shtml |
| Kale | 100,000 to 144,000 | Precheur, et al. (2010)<br>Osborne Seed Company (2010) | http://ohioline.osu.edu/lines/vcrop.html<br>http://www.osborneseed.com/seedcount.cfm?top=no&seedchart=yes&show=no |

| Crop Common Name | Seeds Per Pound | Reference | Link |
|---|---|---|---|
| Kohlrabi | 100,000-150,000 | Green Harvest Australia (2010)<br>Osborne Seed Company (2010) | http://www.greenharvest.com.au/seeds/info_sheet/seeds_per_gram.html<br>http://www.osborneseed.com/seedcount.cfm?top=no&seedchart=yes&show=no |
| Lettuce | 400,000 to 500,000 | Oregon State University (2002-2004)<br>Osborne Seed Company (2010) | http://nwrec.hort.oregonstate.edu/vegindex.html<br>http://www.osborneseed.com/seedcount.cfm?top=no&seedchart=yes&show=no |
| Lupine, grain and forage | 3,175 to 4,082 | Canadian Food Inspection Agency (2010) | http://www.inspection.gc.ca/english/plaveg/seesem/abce.shtml |
| Muskmelon (Cantaloupe) | 16,000 to 20,800 | Kemble (1996)<br>Dainello (2003) | http://www.aces.edu/pubs/docs/A/ANR-0974/<br>http://aggie-horticulture.tamu.edu/extension/vegetable/cropguides/ |
| Oat | 13,000 to 18,144 | Hall (2010)<br>Canadian Food Inspection Agency (2010) | http://plantsci.sdstate.edu/smallgrains/html.cfm?id=2&area=Small%20Grain<br>http://www.inspection.gc.ca/english/plaveg/seesem/abce.shtml |
| Onion | 100,000 to 130,000 | Voss and Mayberry (1999) | http://www.ucanr.org/freepubs/docs/7239.pdf<br>http://www.ucanr.org/freepubs/docs/7242.pdf http://www.ucanr.org/freepubs/docs/7243.pdf |
| Onions, bunch | 190,000 | Osborne Seed Company (2010) | http://www.osborneseed.com/seedcount.cfm?top=no&seedchart=yes&show=no |
| Parsely | 150,000 to 296,500 | Oregon State University (2002-2004)<br>Osborne Seed Company (2010) | http://www.osborneseed.com/seedcount.cfm?top=no&seedchart=yes&show=no<br>http://nwrec.hort.oregonstate.edu/vegindex.html |
| Pea, field | 1,600 to 5,000 | Schatz, B. and G. Endres (2003) | http://www.ag.ndsu.edu/pubs/plantsci/rowcrops/a1166w.htm |
| Pea, Garden | 1,361 to 2,800 | Oregon State University (2002-2004)<br>Canadian Food Inspection Agency (2010) | http://nwrec.hort.oregonstate.edu/vegindex.html<br>http://www.inspection.gc.ca/english/plaveg/seesem/abce.shtml |
| Pea, Southern (cowpea) | 3,200 to 4,000 | Dainello (2003) | http://aggie-horticulture.tamu.edu/extension/vegetable/cropguides/ |
| Peanut | 460 to 907 | Bradley and Pearce (2004)<br>Canadian Food Inspection Agency (2010) | http://www.ces.ncsu.edu/edgecombe/newsletters/soybeanplanting.html<br>http://www.inspection.gc.ca/english/plaveg/seesem/abce.shtml |
| Peppers | 50,000 to 72,000 | Oregon State University (2002-2004)<br>Osborne Seed Company (2010) | http://www.osborneseed.com/seedcount.cfm?top=no&seedchart=yes&show=no<br>http://nwrec.hort.oregonstate.edu/vegindex.html |
| Potato | 5 to 11 | Johnson (Undated) | http://www.umext.maine.edu/onlinepubs/pdfpubs/2412.pdf |
| Pumpkin | 1,600 to 6,400 | Oregon State University (2002-2004) | http://nwrec.hort.oregonstate.edu/vegindex.html |
| Radish | 32,000 to 50,000 | Egel, et al. (2010)<br>Osborne Seed Company (2010) | http://www.btny.purdue.edu/Pubs/ID/id-56/<br>http://www.osborneseed.com/seedcount.cfm?top=no&seedchart=yes&show=no |
| Rape (Canola) | 90,000 to 115,000 | Monsanto (2006) | http://www.monsanto.com/monsanto/ag_products/pdf/input_traits/winter_Canola.pdf |
| Rice | 15,600 to 28,100 | Delta Farm Press (2007) | http://deltafarmpress.com/seed-pound-and-average-number-seed-square-foot-rice-varieties |
| Rutabaga | 150,000 to 192,000 | Orzolek, et al. (2009)<br>Osborne Seed Company (2010) | http://pubs.cas.psu.edu/FreePubs/pdfs/agrs028.pdf s<br>http://www.osborneseed.com/seedcount.cfm?top=no&seedchart=yes&show=no |
| Rye | 18,000 | Pennington (2010) | http://www.penningtonseed.com/ |
| Ryegrass, perennial | 217,728 to 330,000 | Pennington (2010)<br>Canadian Food Inspection Agency (2010) | http://www.penningtonseed.com/<br>http://www.inspection.gc.ca/english/plaveg/seesem/abce.shtml |
| Safflower | 13,608 | Canadian Food Inspection Agency (2010) | http://www.inspection.gc.ca/english/plaveg/seesem/abce.shtml |
| Sorghum (*Sorghum bicolor*) | 11,000 to 25,000 | University of Arkansas Cooperative Extension Service (undated)<br>Buckley (2002) | http://www.aragriculture.org/crops/sorghum/Grain_Sroghum_Seeding_Tables.pdf<br>http://www.co.morton.nd.us/vertical/Sites/%7B90CBB59C-38EA-4D41-861A-81C9DEBD6022%7D/uploads/%7B09494A1C-6D80-497B-86CD-559B2126BC3C%7D.PDF |
| *Sorghum almum* | 68,040 | Canadian Food Inspection Agency (2010) | http://www.inspection.gc.ca/english/plaveg/seesem/abce.shtml |
| Soybean | 1,500 to 3,600 | Osborne Seed Company (2010) | http://www.osborneseed.com/seedcount.cfm?top=no&seedchart=yes&show=no |

| Crop Common Name | Seeds Per Pound | Reference | Link |
|---|---|---|---|
| | | Lee and Herbek (2004) | http://www.ca.uky.edu/agc/pubs/agr/agr182/agr182.pdf |
| Soybean, natto-type | 5,897 | Canadian Food Inspection Agency (2010) | http://www.inspection.gc.ca/english/plaveg/seesem/abce.shtml |
| Soybean, Vegtable (Edamane) | 2,600 to 3,600 | Lee and Herbek (2004) | http://www.ca.uky.edu/agc/pubs/agr/agr182/agr182.pdf |
| Spinach | 40,000 to 45,360 | Canadian Food Inspection Agency (2010)<br>Orton, et al. (2010) | http://www.inspection.gc.ca/english/plaveg/seesem/abce.shtml<br>http://njveg.rutgers.edu/ |
| Squash | 1,920 to 6,400 | Dainello (2003) | http://aggie-horticulture.tamu.edu/extension/vegetable/cropguides/ |
| Sugar beet | 22,000 to 40,000 | Michigan Farm Bureau (2002)<br>Holly Hybrids (Undated) | http://www.michfb.com/files/education/factcards/sugarbeets.pdf<br>http://www.beetseed.com/agronomy/diseases/bolting.php |
| Sunflower (oil-type) | 5,000 to 9,000 | Manitoba Agriculture, Food and Rural Initiatives. Undated. | http://www.gov.mb.ca/agriculture/crops/oilseeds/bgd01s01.html |
| Sunflower (confection-type) | 2,000 to 5,000 | Manitoba Agriculture, Food and Rural Initiatives. Undated. | http://www.gov.mb.ca/agriculture/crops/oilseeds/bgd01s01.html |
| Tomato | 120,000 to 190,000 | Green Harvest Australia (2010) | http://www.greenharvest.com.au/seeds/info_sheet/seeds_per_gram.html |
| Trilicale | 15,000 to 22,680 | Canadian Food Inspection Agency (2010)<br>Pennington (2010) | http://www.inspection.gc.ca/english/plaveg/seesem/abce.shtml<br>http://www.penningtonseed.com/ |
| Turf (Bluegrass, Kentucky) | 1,440,000 | Pennington (2010) | http://www.penningtonseed.com/ |
| Turf (Buffalo grass) | 42,000 | Bamert Seed (2010) | http://www.bamertseed.com/seeds.html |
| Turf (ryegrass, perennial) | 217,728 to 330,0000 | Pennington (2010)<br>Canadian Food Inspection Agency (2010) | http://www.penningtonseed.com/<br>http://www.inspection.gc.ca/english/plaveg/seesem/abce.shtml |
| Turnip greens | 167,000 | Orzolek, et al. (2009) | http://pubs.cas.psu.edu/FreePubs/pdfs/agrs028.pdf s |
| Watermelon | 4,800 to 9,600 | Dainello (2003) | http://aggie-horticulture.tamu.edu/extension/vegetable/cropguides/ |
| Wheat, durum | 12,400 to 14,200 | North Dakota State University (2002) | http://www.ag.ndsu.edu/AgCMS/procrop/2002-seeds-per-pound-durum-wheat-on-no-till-recrop-at-minot |
| Wheat, hard red spring | 11,000 to 18,000 | Albert Lea Seed (2010b) | http://www.alseed.com/organic_seed/small_grains/spring_wheat.php |
| Wheat, hard red winter | 11,000 to 18,000 | Albert Lea Seed (2010a) | http://www.alseed.com/farm_seed/small_grains/winter_wheat.php |
| Wheat, soft red winter | 9,550 to 17,850 | McKendry et al. (2009) | http://agebb.missouri.edu/cropperf/wheat/soft/varproc.htm |
| Wheat, soft white | 8,000 to 15,000 | Flowers and Peterson (2008) | http://extension.oregonstate.edu/catalog/pdf/em/em8957-e.pdf |

APPENDIX B REFERENCES


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