Seed Tablets for Precision Planting Lettuce

*by B. L. Harriott**

As the supply of agricultural labor continues to decline, mechanization of food production operations becomes increasingly important. Next to harvesting, stand establishment is the most expensive production operation for many crops. Several Arizona crops fall into this category because the small size and/or irregular shape of the seeds makes precision planting difficult. Seeding rates from 5 to 50 times the desired plant population are used and hand thinning is required to eliminate excess plants.

Seed variations, differences in germination environments, crowding of plants before thinning and plant injuries during thinning all contribute to uneven growth. This lack of uniform development continues throughout the growing season and makes multiple harvest in each field necessary for several Arizona vegetable crops. The selective nature of multiple harvests increases the complexity and costs of harvesting machinery

*Associate Agricultural Engineer at the Mesa Farm, Arizona Agricultural Experiment Station, Mesa, Arizona.

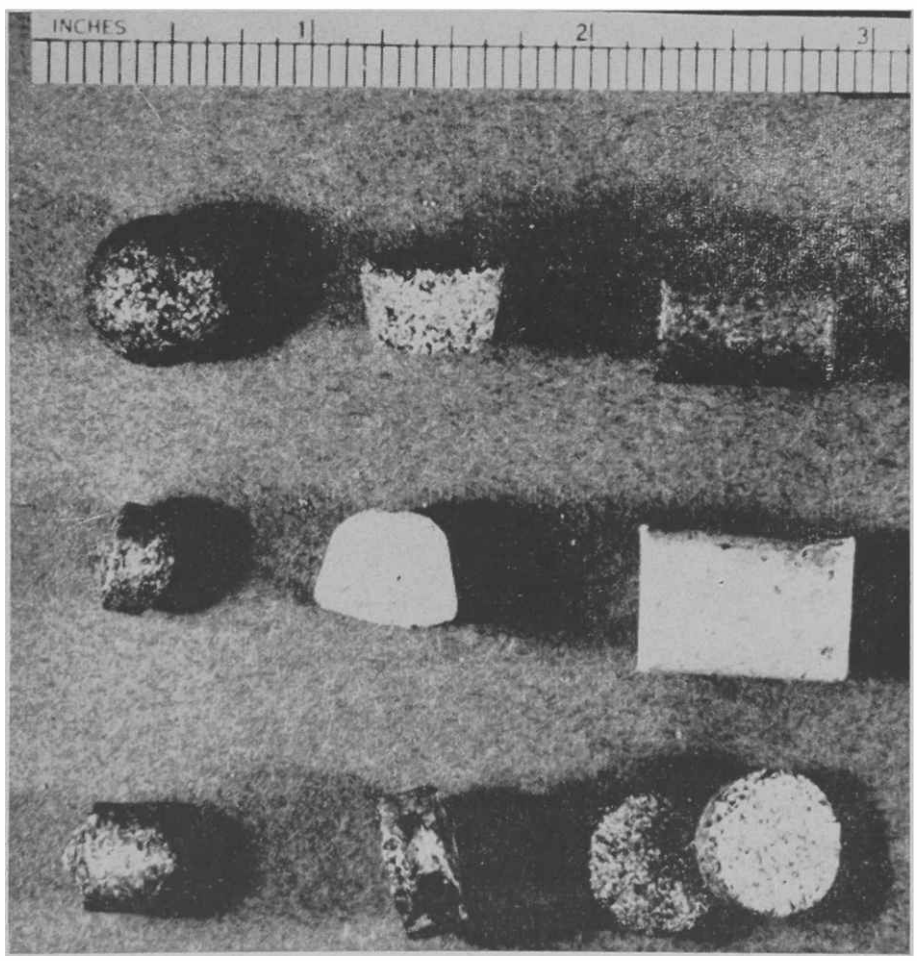

Figure 1. Shown above are some of the different spherical, cylindrical, cone, and disk shapes used in early seed tablet planting experiments. The disk shape provides the best emergence and uniformity results.

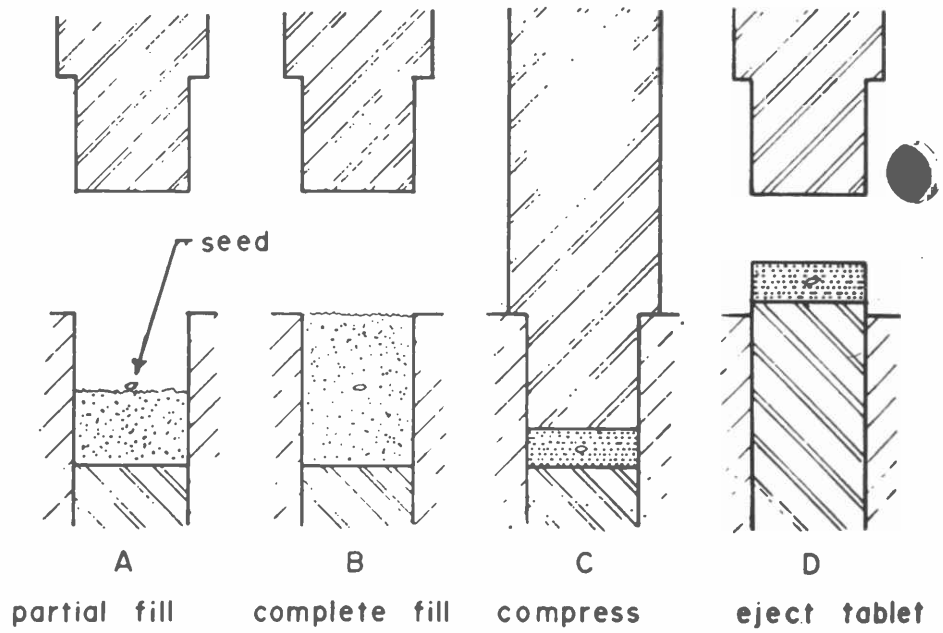

Figure 2. Cross section drawings of a tablet press show the sequence of events during the tablet production process. The loose vermiculite is compressed to ¼ its original volume around the seed and the polyvinyl acetate in the mixture acts as a glue to hold the tablet shape after compression.

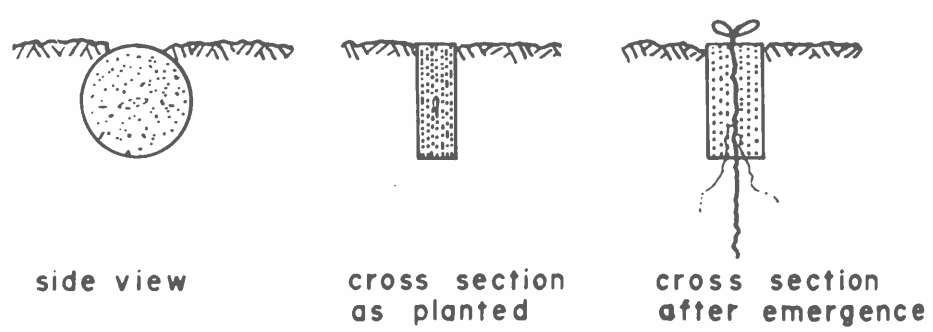

Figure 3. The three views above show the planted tablet. Because the seed is located at the center of the tablet, planting depth for each seed is ½ the tablet diameter. Some expansion of the tablet occurs as it absorbs moisture during irrigation.

needed to reduce current labor requirements. If a crop such as lettuce could be precision planted, hand labor for thinning could be eliminated and plant uniformity might be improved to the point where once-over mechanical harvest would be feasible. Precision planting, as used in this discussion, means accurate spacing of single seeds in the row, precise control of planting depth, and a uniform germination environment for each seed.

Field experiments aimed at investigating methods for precision planting lettuce were intiated by the U. of A. Agricultural Engineering Department in 1964. More than 60 variations of seedbed preparations, seed treatments, seed coatings, soil amendments, and mulch applications were field tested during the first three years of work. The most consistently high germination and emergence results were achieved by accurately spacing naked seed in a vee shaped furrow in the seedbed, filling the furrow with loose vermiculite, and spraying a polyvinyl acetate binder over the vermiculite. In addition to providing an excellent germination environment, the vermiculite cover also prevented any soil crusting above the seed and seedling emergence was not restricted. However, the system was complicated because of the sequence of operations involved and the difficulty in separating seeds accurately under field conditions.

The advantages of the vermiculite furrow system were retained and the disadvantages eliminated with the seed tablet method. In this system, each seed is encased in compressed vermiculite prior to the planting operation. Several different sizes and shapes of seed tablets, as shown in Fig. 1 have been used in planting trials at the University of Arizona, Mesa Station. The accompanying table lists representative emergence results from several experiments in which lettuce was precision planted with the tablet system. A ¾ inch diameter by ¼ inch thick disk shaped tablet with a seed at its center is now being used for all experiments. The tablets are produced by mixing 10 parts vermiculite, 2 parts water, and 1 part polyvinyl acetate by weight and then compressing this mixture to ¼ the original volume around the seed, as shown in Fig. 2. In a commercial situation, the tableting would be done at a seed distribution location where seed sorting and separation can be accomplished under controlled conditions and the tablets stockpiled before planting.

Lettuce Plant Emergence from Vermiculite Tablets

Planting Date	*Tablet Configuration*	*Irrigation Type*	*Emergence (%)*
1966 — Spring	**3/8 x 3/8 cylinder**	**furrow**	**80**
1966 — Fall	**1/2 x 5/16 cone**	**furrow**	**55**
1967 — Spring	**1/2 x 5/16 cone**	**furrow**	**89**
1966 — Fall	**1/2 x 3/16 disk**	**furrow**	**60**
1967 — Spring	**1/2 x 3/16 disk**	**furrow**	**92**
1967 — Fall	**1/2 x 3/16 disk**	**furrow**	**59**
1967 — Fall	**1/2 x 3/16 disk**	**sprinkler**	**83**
1969 — Spring	**1/2 x 3/16 disk**	**sprinkler**	**89**
1968 — Fall	**3/4 x 1/4 disk**	**sprinkler**	**73**
1969 — Spring	**3/4 x 1/4 disk**	**sprinkler**	**95**
1969 — Fall	**3/4 x 1/4 disk**	**sprinkler**	**85**

Planting is accomplished by pushing the tablet into a properly prepared seedbed that is free of clods. Fig. 3 shows the planted tablet. The top of the tablet is left exposed at the soil surface to provide a noncrusting emergence area for the seedling. A mechanism to orient the tablets and place them accurately in the seedbed must now be developed. Fig 4 shows an artist's conception of a future tablet planter. Because all of the seeds are located at the center of identical tablets, a uniform germination environment is provided for each seed and a uniform emergence zone is provided for each seedling. In this way, variations in emergence and plant growth are limited to the germination characteristics and vigor of the seed. With proper seed selection[1] and treatment, the seed tablet system makes planting to a final stand and once-over harvest feasible for lettuce. It is anticipated that the system will also be advantageous for other crops where stand establishment is a problem and where improved plant uniformity is needed.

[1] *Sharples, George C., Seed Size Effects on Lettuce Germination & Growth, Progressive Agriculture in Arizona, Vol. XXII, No. 6, November-December, 1970.*

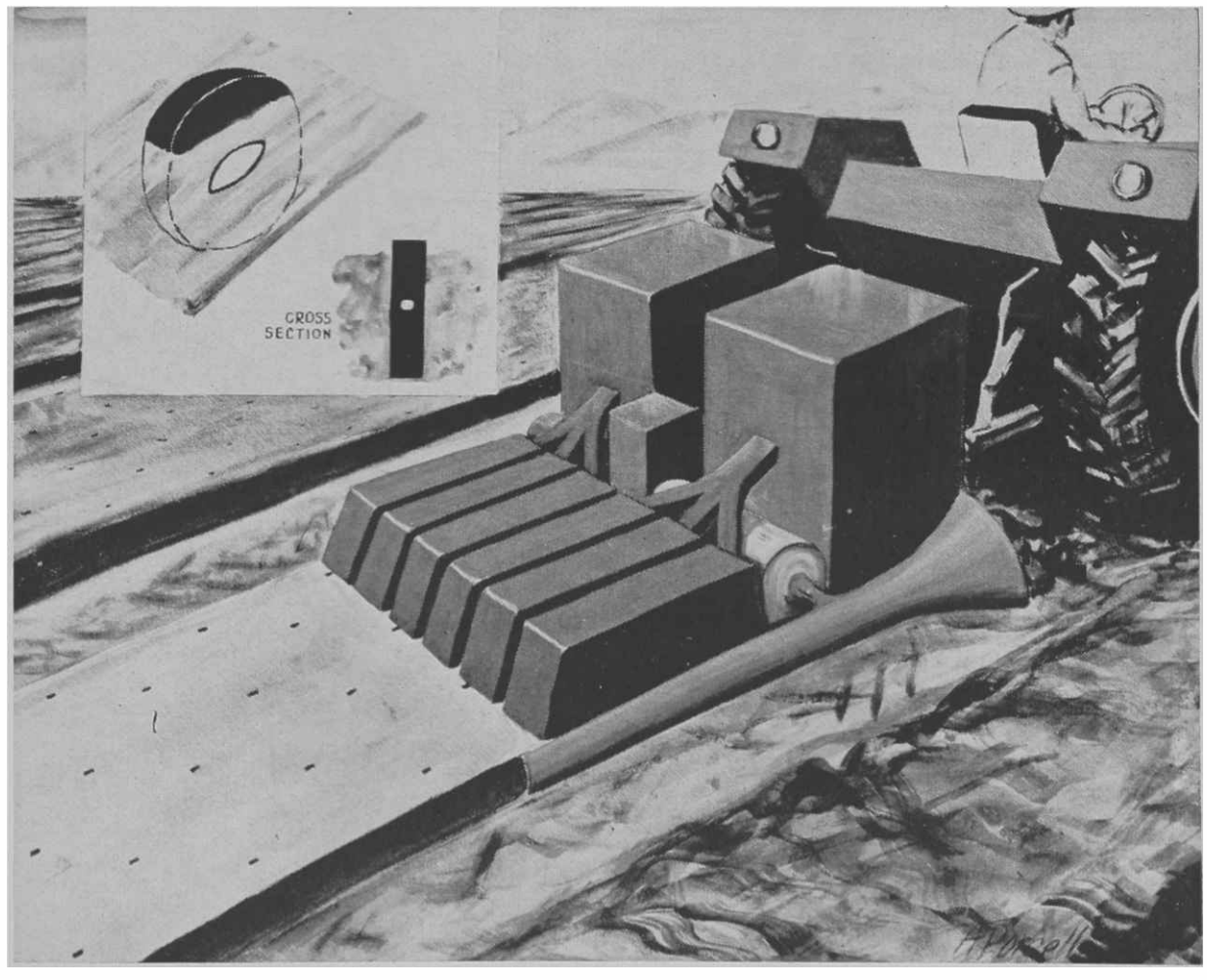

Figure 4. A future planter for seed tablets may look something like the one in the drawing above. The machine is shown planting six rows of tablets in an alternating pattern on a 60 inch wide bed.