Equipment Modifications *for* Harvesting Fluffy Seeds

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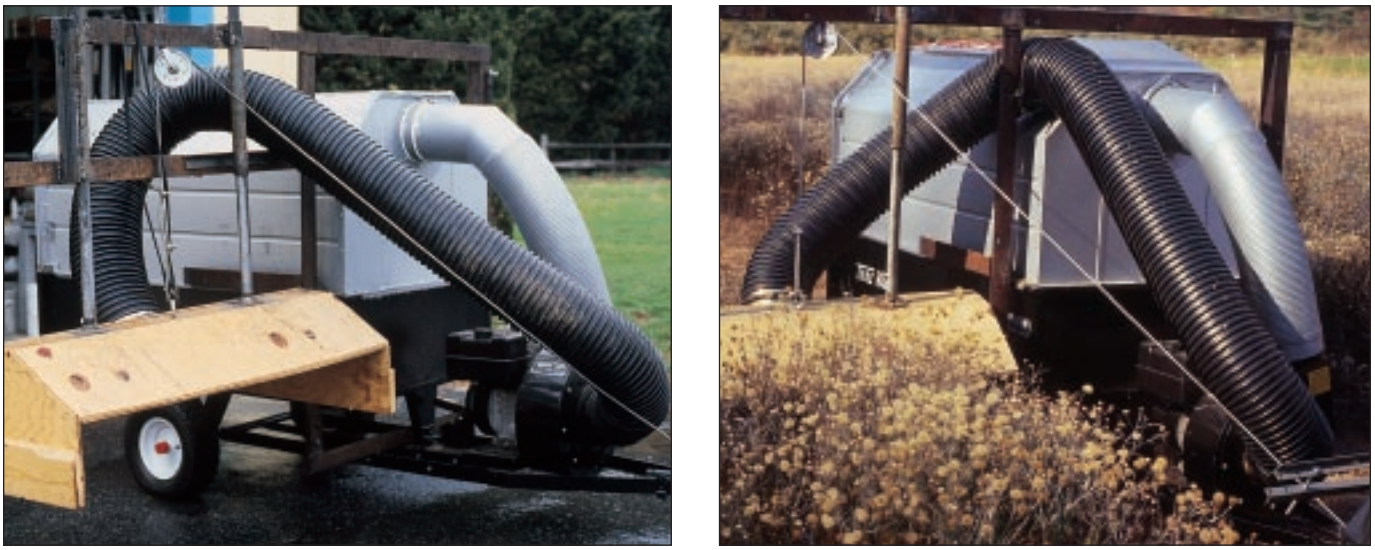

Left photo by Jennifer Kujawski. Right photo by John M Englert

Figure 1 • Left: The pull-behind leaf vacuum and the plywood hood sized to fit over a row of native seeds. Right: Harvesting fluffy seeds.

ABSTRACT

Fluffy seeds of native wildflowers are difficult to harvest using traditional equipment and methods. We modified intake and storage on a tractor-drawn leaf vacuum machine to better harvest fluffy seeded species such as aster (*Aster* L. [Asteraceae]) and narrowleaf silkgrass (*Pityopsis graminifolia* (Michx.) Nutt. [Asteraceae]). By inserting collection bags inside the vacuum and creating a vacuum hood to ride over the rows of plants, only 1 person is needed for the harvest process. The modified equipment allows us to make repeated harvests over the several-week ripening period and it removes only ripe seeds from the plants.

At the USDA NRCS National Plant Materials Center in Beltsville, Maryland, we produce seeds of many types of wildflowers and native grasses. Some species we work with are easily harvested with a combine; others, however, are not. In particular, light-seeded species with hairy pappus on their seeds, such as asters (*Aster* L. [Asteraceae]), goldenrods (*Solidago* L. [Asteraceae]), and narrowleaf silkgrass (*Pityopsis graminifolia* (Michx.) Nutt. [Asteraceae]) are very difficult to combine. To make matters more complicated, their seeds ripen over a period of several weeks, and a one-time harvest pulls ripe and unripe seed off together (with the possible loss of some already matured seeds).

Our previous method for harvesting these types of seeds was to cut the stems of nearly ripe seeds with a sickle bar, spread out stems on a tarp to let seeds mature, and then release seeds by tossing the stems in the air with a pitchfork or rubbing the stems over wire screens. This seed harvest and extraction process required several steps, a large space for spreading out stems, and still resulted in the harvest of some immature seeds. Other harvest equipment options we considered included variations of a vacuum-brush seed stripper, but these machine were expensive, tended to strip the whole seed head instead of just pulling off the ripe seeds, and resulted in some stems, leaves, and other chaff

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being harvested with the seeds. We needed a piece of equipment that would allow us, with a minimum number of people, to maximize the harvest of ripe seeds only while minimizing chaff.

In 1994, based on trials with a portable leaf vacuum, we decided to purchase a larger leaf vacuum (1.8-m^3-capacity [50-bushel] leaf and grass Trac Vac vacuum, Model 880, Palmor Products Inc, Thorntown, Indiana) designed to be pulled by a riding mower (we use an 18-horsepower tractor). The unit appeared to meet our needs: with its intake hose we would be able to vacuum off mostly ripe seeds (easily dislodged) and make several passes over a field during the seed ripening period. In addition, very little chaff would end up with the harvested seeds since the hose would be riding over the tops of rows, only in contact with seedheads.

The Trac Vac unit required a series of modifications before it could be used for tiny wildflower seeds. To minimize the number of people handling the hose during harvest, we wanted the hose to pull seeds from an approximately 1-m-wide (36-in) row while floating over plants of variable heights. We built a123-cm-wide (48-in) triangular hood from 3 pieces of plywood (Figure 1). The front piece of the hood is 28 cm (11 in) high and angled forward. It connects to a 10-cm (4-in) by 123-cm (48-in) top piece from which the hood is supported. The back section is 44 cm (17.5 in) long and angled away at the base. A 20-cm (8-in) diameter hole was cut in the back for inserting the hose. Next, we welded a frame from angle-iron that fits around the front of the storage box with a top piece that extends 106 cm (43 in) and a middle arm that extends 123 cm (48 in) out to 1 side. The hood with hose attached sits under this extension and is held at a 90° angle to the storage unit by two 2.5-cm (1-in) diameter metal pipes that slide through 3.8-cm (1.5-in) diameter pipes welded to the angle-iron frame extensions. A pulley attached to the top of the frame and threaded with a 6-mm-diameter (0.25-in) metal cable from the hose hood to the tractor's rear hydraulic bar allows the operator to raise and lower the hood as needed. Inside the hood we added 15- to 20-cm-long (6 to 8 in) chains; these chains knock recalcitrant ripe seeds off plants. The hood is heavy so we added counterweight to the opposite side of the storage box in the form of a concrete block.

Secondly, we had to make the unit as air tight as possible, otherwise seeds would be sucked in but would escape with the air flowing through the grate at the top of the storage container and through the container's seams, which were simply bolted together. This was solved by simply installing a large (123 X 114 cm [48 X 45 in]) Typar seed bag (Advance Specialties, Paris, Tennessee) over the intake hose inside the storage unit. A 20-cm (8-in) diameter hole was cut in the side of the bag. Two 28 X 28 cm (11 X 11 in) pieces of 1.25-cm-thick (0.5-in) plywood had a 20-cm (8-in) diameter circle cut out of each piece. The wood pieces were aligned with the hole on the side of the bag, one inside, one outside; caulking was used to form a tight seal between the bag and each piece of plywood (Figure 2). This plywood-bag-plywood "sandwich" was secured with 4 small bolts. Four additional 9.5-mm (3/8-in) bolts were inserted through the plywood facing toward the outside of the bag, to be used for keeping the bag in place over the vacuum hose. All seams on the bag were stitched closed, and the side opening was fitted over the small section of intake hose protruding into the storage box. The outward facing bolts were driven through the side of the storage unit and held in place with wing nuts. This modification allowed vacuumed seeds to go directly into the bag, which could then be unscrewed from the unit and seeds emptied out. A separate collection bag for each species avoids the necessity of having to thoroughly clean out a single bag between harvesting different species; we only have to screw on the appropriate bag.

All of the modifications to the original Trac Vac unit were inexpensive—amounting to less than US $400. The Trac Vac itself cost about US $1750 in 1994. At this point, the machine is performing acceptably: operated by 1 person, sucking ripe seeds off plants with few to no extraneous plant parts, and useful for repeated harvests over the ripening period of a species. Future improvements that we would like to implement include: 1) better distribution of the vacuum across the row width (right now suction occurs at the one point at which the hose protrudes through the hood); and 2) modification of the hood shape to knock off more seeds.

Photo by Jennifer Kujawski

Figure 2 • Typar seed bag modified with plywood supports that connect to the hose discharge inside the leaf vacuum.

REFERENCE

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