Evaluation of Air Threshing for Small Lots of Winterfat Fruits

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Abstract

Air threshing, using an air gun scarifier, is an improved method for threshing small lots of winterfat [Eurotia lanata (Pursh) Moq.; Ceratooides l. (Pursh) J.T. Howell] fruits for laboratory analysis. The technique is faster than hand threshing and causes insignificant damage to the seed in contrast to hammer mill threshing which damages about 25% of the seed.

Winterfat [Eurotia lanata (Pursh) Moq.; Ceratooides l. (Pursh) J.T. Howell] seed has been removed from its enclosing bracts by threshing in a hammer mill at 500 rpm using a 6.4 mm screen (Wendall Oaks, USDA-Soil Conservation Service, Los Lunas Plant Materials Center, personal communication, 1979). Stevens et al. (1977) recommended using the hammer mill at 1,000 - 1,200 rpm with a 7.94-mm screen to separate the fruits from the seed stalks, but their methods are not intended to thresh the seed from the bracts. Booth (1982) and Booth and Schuman (1983) have shown that the bracts which enclose the utricle of winterfat are important adjuncts to seedling establishment and seedling vigor and should not be removed before planting. However, various laboratory procedures require that these bracts be removed. Booth (1984) found that hammer mill threshing damaged or removed that radicle apex and its contributing meristem on 25% of the seed. The meristematic area, where growth occurs, is also an area in which nutrients and growth regulators are concentrated. For these reasons inaccurate data could result when hammer mill threshed seed is used in germination tests or in an analysis of plant growth factors in the seed. Threshing seed by hand, even with the help of a rubbing board, is a time-consuming and tedious process. Air threshing, using an air gun seed scarifier, was tested as an alternative to hand...
or hammer mill threshing of small lots of winterfat fruits. The air

gun scarifier was originally designed to enhance germination of
small legumes (such as alfalfa) by scratching the seed coat to
promote seed imbibition.

**Air Gun Scarifier**

The air gun scarifier (Fig. 1) consists of a metal cylinder (3-mm
thick walls × 115-mm height × 100-mm inside diameter) with an
uneven inside coating (2-5 mm thick) of silicone rubber (such as
Silicone II caulking by General Electric) mixed with emory dust.

When scarifying seed, this coating holds emory cloth in place in the
cylinder. Emory cloth is not used when threshing winterfat. The
cylinder is covered by a metal ring machined to fit the top of the
cylinder. The ring has a 60-mm diameter center covered by a 1-mm
metal screen. This lid is secured by a 6 × 12-mm wing bolt through
the side of the cylinder. A metal funnel is permanently attached to
the bottom of the cylinder. A pipe (10-mm inside diameter and 150
mm long) enters the side 30 mm from the top and offset 35 mm
from the center of the cylinder. An air pressure regulator and
gauge, air trigger and air hose coupling, respectively are attached
to the distal end of the pipe. A small metal funnel is attached to the
top of the pipe at about a 60° angle and provides an 8-mm diameter
opening into it. Winterfat fruits fed into the funnel are shot
through the pipe into the cylinder where contact of the fruits
against the coated sides separates seeds from the enclosing bracts.

The implement can be easily constructed in a machine shop for
about $100.00.

**Methods**

Winterfat fruits (454 g of selection U60-80) were cleaned of stems
and debris then threshed using the air gun at 345 k Pa. Fruit bracts
were separated from seeds by passing a light airflow across the
seed.

Five samples of 100 seeds were randomly selected from the
threshed seed. These were examined microscopically to determine
the number of seeds damaged by threshing. After microscopic
examination the seed samples were soaked over the weekend at 0 ±
2°C (Booth and Schuman 1983), incubated for 2 1/2 days at 21°C
for 16 hours and 4.4°C for 8 hours, then evaluated for positive
geotropic response relative to the total germination.

**Results and Discussion**

One hour was required to thresh the winterfat fruits. Damaged
seed averaged 2.4% over the 5 replicate samples. Seedlings without
a positive geotropic response averaged 3.7% of the germinated
fruits. This compares to 25% damage and 24% without a positive
geotropic response for hammer mill threshed seed (Booth 1984,
Booth and Schuman 1983).

The air gun method is twice as fast as threshing winterfat seed
using a rubbing board and yields cleaner seed. The amount of seed
damaged by this process is insignificant but might be reduced by
increasing the thickness of the silicone rubber coating and by
adjusting the air pressure. Air threshing uses tearing stress more
than impact to remove the seed coverings. It is an alternate method
to be considered for other plant species when impact methods
damage the seed. The air threshing method offers a means of
obtaining undamaged threshed winterfat seed for laboratory anal-
ysis at a low cost relative to hand threshing. It is recommended that
the operator use ear plugs and a dust mask when air threshing
winterfat.

**Literature Cited**

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