prevent drying, the petri dishes were placed in polyethylene bags sealed with rubber bands. Throughout a 12-day germination period the seeds were kept on top of a laboratory bench at room temperatures varying from 72 F to 78 F. Temperatures were recorded by a Belfort[2] hygrothermograph.

Growth of the radicle to a length of 5 mm was the criterion used to indicate germination. Germination counts were made after 2, 5, 8, and 12 days.

Results and Discussion

Fig. 1 shows spotted and nonspotted bitterbrush seeds prior to the germination test.

Germination was virtually completed after 5 days, at which time 78% of the spotted seeds had germinated compared to 95% of the nonspotted seeds. The few seeds that germinated during the next 7 days raised the germination percentages by less than 1%.

We do not know what causes the spotting or the loss in viability. Basile and Ferguson (1964) found that the Say stink bug (*Chlorochroa sayi* Staal) could cause the complete blackening and shriveling of immature bitterbrush seed, but found no definite evidence that this insect was responsible for spotted seed.

We also tried to determine what part of the seed was damaged by the agent responsible for the spots. Spotted seeds were soaked in water for several hours, after which the seed coats were removed. These seeds were then placed overnight in a 2%, 2, 3, 5-triphenyl tetrazolium chloride solution, which normally stains only the living portions of the seed bright red. In 25% of the seeds treated, the tip of the embryo was stained only slightly or not at all. Fifty-three percent of the seeds had either deformed (wrinkled) cotyledons or cotyledons with pink or white spots—which indicated some necrosis. In a few cases, both the embryo and cotyledons were damaged. Despite being spotted on the outer seed coat, 31% of the seeds were stained red throughout both the embryo and cotyledons, and appeared undamaged.

FIG. 1. Spotted bitterbrush seed (left) and nonspotted seed (right) before testing for germination. The area of the seed coat covered by the spot (or spots) varies greatly.

Since most spotted and nonspotted seeds are approximately the same size, shape, and weight, they probably cannot be separated in the cleaning process, nor will the purity analysis be affected. Consequently, seed collectors should examine shrubs carefully to ascertain if the seed is good, viable, unspotted seed before they gather it. If such precautions are not taken, we will have to develop some practical method for culling out defective seed after it is harvested.

The deleterious effect of spotted seed in a seed supply will depend on the proportion of the seeds affected and the severity of damage to the individual seeds. This can be determined in a careful germination test of a representative sample of the seed lot.

LITERATURE CITED

BASILE, JOSEPH V., AND ROBERT B. FERGUSON. 1964. Say stink bug destroys bitterbrush seed. J. Range Manage. 17:153-154.

FERGUSON, ROBERT B., MALCOLM M. FURNISS, AND JOSEPH V. BASILE. 1963. Insects destructive to bitterbrush flowers and seeds in southwestern Idaho. J. Econ. Entomol. 56:459-462.

[2] *Use of trade names of commercial products is solely for identification and does not imply endorsement by the U.S. Department of Agriculture or the Forest Service.*

Weighing Forage Samples on Windy Ranges

Richard S. Bjerregaard

Formerly Field Assistant, Intermountain Forest & Range Experiment Station, Forest Service, U.S.D.A., stationed at Provo, Utah; presently, student, Department of Botany, Brigham Young University, Provo, Utah.

Exasperation was the mother of this idea. There was always at least a breeze, more often a gale, during the summer of 1966 when I worked in the field for the Intermountain Forest and Range Experiment Station. Grass clipped from small sample plots had to be weighed in the field for subsequent dry-matter determinations, but the paper bag on the hook of the spring-balance never seemed to come to rest.

At first I tried a section of 6-inch stovepipe as a stilling well, but the diameter was too small for the size of bag we were using. An 8-inch rain can, 30 inches deep, worked much better. Since it had a bottom, it also served as a carrying case for the clipping and weighing tools.

The westerlies dipped only a few inches into this improvised "bucket of calm," even when they whipped by at 20 mi/hr. If the can had been

wider, the turbulence would have reached farther down. If such is required for larger samples, a can that is also taller may be used.

The pointer on our scales stayed a constant distance from the hook. This was distance enough for our sample—no matter how light—to be down out of the weather, while the pointer remained above the rim of the can where we could read it. For other types of scales, it may be necessary to lengthen the hook 3 or 4 inches in order to have the samples (especially very light ones) in still air when the weights are read. It is also helpful to have a pebble of known weight in the bag with a lightweight sample to make it hang vertically and not touch the side of the stilling well.