Cesium-137 In *Bromus tectorum* L. In Relation To Precipitation Regimes And Harvest Yields[1]

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Highlight

Salubrious spring precipitation increased downy brome yield but not ^{137}Cs concentration in downy brome.

Downy brome, *Bromus tectorum* L., was harvested from an abandoned field on the Hanford Reservation, Benton County, Washington, in May 1963 and 1964. The field has been out of agricultural use for about 20 years and since then has probably supported a volunteer sward of downy brome every year. The vegetation of the field at this time is comprised almost entirely of downy brome. A few summer annuals, mostly Russian thistle, *Salsola kali* L., and Jim Hill mustard, *Sisymbrium altissimum* L., become conspicuous after downy brome matures and becomes dry.

The field is protected from livestock grazing and wild herbivores, e.g., jackrabbits seldom are seen in the field. Downy brome grows during the cool winter and spring months so that there appears to be little consumption of foliage by insects. The harvest yield of aboveground parts therefore provides a close estimate of annual production as determined by weather.

The clipping of downy brome from ten 1 x 1m plots was done in May when plants were mature but before loss of plant parts such as the shedding of seeds became pronounced. Radiochemical analyses were made on 100-200 g lots of finely milled dry grass by gamma spectrometric techniques employing a 9 x 11 inch sodium iodide (T1) crystal. Yield is expressed as dry matter (105 C)/m^2.

A harvest of only 17 g/m^2 ± 2 (SE) was obtained in 1964 and was related to the driest precipitational regime measured during 50 years of record (Table 1). By contrast, an exceptionally large yield of 236 g/m^2 ± 8(SE) was harvested in 1963. Early precipitation and moderate temperatures in the autumn of 1962 promoted prompt germination of seeds and the early establishment of seedlings. The following April 1963 was also favored by a greater than usual amount of precipitation in conjunction with moderate air temperatures. This combination of early fall precipitation and above normal April precipitation appeared to be important factors in the growth of downy brome. Worldwide fallout is deposited over the earth's surfaces largely by precipitation but some is also deposited dry (Hardy and Alexander, 1962). The ^{137}Cs content of air sampled at Richland, Washington was not very different in 1964 as compared to 1963 (Perkins et al. 1964). The ^{137}Cs concentration in downy brome was also closely similar during both years. In 1963, ^{137}Cs measured 1.5 ± .068 picocuries/g dry weight as compared to 1.7 in 1964. The entire 1964 harvest of 10 m^2 was placed into one counting container.

Table 1. Precipitation (inches) throughout the downy brome growing season of 1962-1963 and 1963-64.[1]

Month	1962-63	1963-64	Long term Average
October	0.95	0.04	0.73
November	0.65	0.75	0.77
December	0.60	1.14	0.87
January	0.95	0.37	0.98
February	0.69	0.01	0.63
March	0.53	0.03	0.48
April	1.17	0.11	0.37
May	0.43	0.04	0.50
Grand total	5.97	2.48	5.33

[1]Climatological data from the Hanford Atomic Products Operation Meteorology Station, Richland, Washington.

The relatively abundant precipitation in the spring of 1963 contributed to the yield of downy brome but not to increased concentrations of ^{137}Cs. Although ^{137}Cs has undoubtedly been accumulating in the soil over the years, little absorption is expected to enter grasses from the soil because of the strong affinity of soil colloids for ^{137}Cs.

Although the concentrations of ^{137}Cs in downy brome were closely similar in 1963 and 1964, about 350 pCi/m^2 were available for grazing animals in 1963 as compared to only 29 pCi/m^2 in 1964. It is clear that any measurement of concentration of ^{137}Cs in downy brome has limited use for estimating biologically available ^{137}Cs in downy brome pastures. By sampling plots, estimates of the ^{137}Cs potentially available to livestock can be made. This point is often overlooked in environmental monitoring surveys.

From these data it appears that spring sampling is a useful means of estimating the annual increment of worldwide fallout deposited over annual grass pastures. The influence of an overstory of shrubs, e.g. big sagebrush on the accumulation of fallout by downy brome has not been investigated.

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LITERATURE CITED

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Control of Prickly Burnet (*Poterium spinosum* L.) in Rangelands of Southern Judean Foothill Region.

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In the south of Israel, between the 250 mm to 500 mm isohyets, about 150,000 dunam[1] of range are covered by varying amounts of the dwarf-shrub, prickly burnet, which is valueless as grazing for cattle and sheep. Repeated failure of attempts to control the plant by aerial sprays of 2,4-D in this area made necessary the present investigation.

Treatments.—Three means of application were compared: Stearman biplane, Piper Cub monoplane, and "Solo" low-volume knap-sack power sprayers.

Five application rates of 2,4-D ethyl, hexyl (isooctyl) ester, 478 gr a.e./liter, were tried: 300 to 600 cl.

[1]*One dunam = 1000 sq meters = 0.25 acre.*

2,4-D per dunam, 2 to 5 liters of spray material per dunam with addition of 10-20% diesel oil to the lower 2,4-D application. Each treatment combination was replicated three times.

Major Results. — Under certain conditions, the lowest applications of 2,4-D gave satisfactory control of prickly burnet. Diesel oil appeared to improve the efficiency of control slightly.

The wind speed at the time of spraying had a decisive effect on the degree of success and even light wind marked the effect of possible differences in application rates. No differences in efficiency of application between the Stearman and Piper were found. Both gave a markedly more uniform control than the "Solo" knapsack sprayer.

In the year after the spray there appeared to be some regrowth of partially killed plants, particularly in the less successful plots. Where initial control was almost complete, there was very little subsequent recovery. Despite drought conditions, the herbaceous vegetation increased considerably in the year after the spray. The cover of annual grasses increased markedly and there was a slight increase in the number of perennial grasses.

Recommended Treatment (per dunam).—Aerial spray dosage: 300 cl. 2,4-D Albar ester (or equivalent) topped to 2 liters with water containing 10% diesel oil. Spraying period: From mid-March to mid-April.

"Solo" knapsack sprayer: 400-450 cl. 2,4-D Albar ester; topped with water to 5-6 litres.

The area should be sprayed when the air is virtually still. Besides the dangers of drift to susceptible crops, even slight wind during spraying reduces efficiency of control drastically.

This trial was carried out by the Merom, Chim-Avir and Resisim spraying companies. The 2,4-D was supplied by Mahteshim Co. Mr. N. Lifshitz, Plant Protection Bureau and Drs. Y. Katznelson and Z. Naveh, Volcani Institute of Agricultural Research, advised on various aspects of the trial.