POTATO SPROUTING INHIBITED BY THE USE OF ALPHA-NAPHTHALENEACETIC METHYL ESTER

ROBERT H. DAINES AND JOHN C. CAMPBELL

New Jersey Agricultural Experiment Station, New Brunswick, N. J.

Some of the most interesting developments arising from plant science investigations during the past relatively few years, have resulted from the studies of plant growth regulators or hormones. Through the use of such materials, the time required for the rooting of cuttings can be shortened, apple dropping delayed, tomato flowers caused to set without being pollinated, blossom drop in wax beans decreased, plants can be killed (weed killer), and the dormant (or rest) period for many plants shortened or extended as desired. Of the above uses, perhaps the one dealing with the extension of the rest period holds the greatest practical interest for most potato growers, since the sprouting of potatoes during the storage period is frequently responsible for rather heavy losses. Such losses result not only from labor costs in removing the sprouts, but from loss in tuber weight incurred from sprout production and maintenance.

During the past few years (since 1938) workers at the Boyce Thompson Institute for Plant Research (2, 3, 4, 5) have conducted much investigational work regarding the effect of various chemicals on potato sprouting. Among those, alpha-naphthaleneacetic methyl ester was proven to be the most effective in suppressing sprouting, although indolacetic acid, the potassium salt of this acid and alpha-naphthylacetate showed definite suppressive activity. Thomas and Riker (6), in 1944, working in Wisconsin, and Daines and Campbell (1943-1944) in New Jersey have corroborated some of these findings.

From an investigation to determine the effect of alpha-naphthaleneacetic methyl ester on the sprouting of potatoes, Denny and associates report that:

"Potato tubers (*Solanum tuberosum L.*) in lots of 20 bushels each, placed in wooden bins shortly after harvest, were exposed to the vapor of the methyl ester or alpha-naphthaleneacetic acid ($C_{10}H_7CH_2COOCH_3$) incorporated into paper towels which were interspersed evenly among the tubers in the bins. An amount of the methyl ester equal to 100 mg. per kg. of tubers inhibited completely the sprouting of the tubers from the 3rd of October, 1941 (shortly after harvest) until the end of the experiment, on the 6th of May. Only a few sprouts were formed by tubers treated with 33 mg. per kg. The storage

temperature was 10° to 15° C. from the 15th of November to the 15th of April, ranging up to 22° to 23° C. in the intervals previous to and subsequent to these dates. Control tubers sprouted freely under the same conditions.

"A similar treatment starting on the 8th of December, 1941 with 50 mgs. per kg. using tubers that were practically out of the natural dormant period at the time, successfully inhibited sprout development until the end of the experiment.

"Treatments applied to tubers stored in triple-walled paper bags (50-lb. capacity), using the same concentrations of chemical at the same temperature and over the same interval, gave responses about the same as those obtained with treatments in bins, provided that the paper towels impregnated with the methyl ester were distributed among the tubers. When the chemical was applied only to the inner layer of the paper bag itself, or to paper towels placed on top of the tubers in the paper bag, inhibition of sprouting was obtained only with the tubers touching the sides of the bag, or in the layer of tubers just below the paper towels.

"When the methyl ester of alpha-naphthaleneacetic acid was incorporated into talcum powder which was then applied as a dust to the surface of each tuber, sprout inhibition was obtained at the rate of only 25 mg. of methyl ester per kg. of tubers."

Experiment — 1943

In an experiment conducted in New Jersey, designed to determine the value of the methyl ester in home storage, Katahdin potatoes were packed into baskets, the sides, tops and bottoms of which were lined with newspapers. The methyl ester was dissolved in alcohol sprayed on paper towels which towels, after drying, were cut into strips. These strips were distributed evenly throughout each basket of treated potatoes. The amount of ester used equalled 36.7 mgs. per kg. or 1 gr. per bushel of potatoes. The potatoes were then stored in two home basements and held from January, 1943 until April of that same year. During this storage period the temperature in each basement varied between 14° and 21° C. At the end of the four-month storage period the potatoes were desprouted and weighed. During this period untreated potatoes produced sprouts at the rate of 2090 grams, whereas treated potatoes produced sprouts at the rate of 501 grams per bushel. At the time this test was terminated, most of the untreated potatoes were so shriveled they were considered unusable. At this same time the treated potatoes, even though somewhat shriveled, were still good for table use.

TABLE 1—*Comparative effectiveness of alpha-naphthaleneacetic methyl ester deposited on paper strips and talc in preventing potatoes from sprouting.*

Quantity of Ester Used per Kg. of Potatoes and Method of Application.	Grams of Sprouts per Bushel of Potatoes
1. Untreated	1896
2. 50 mg.* of the ester deposited on paper strips.	327
3. 50 mg. of the ester deposited on talc	47
4. 25 mg. of the ester deposited on talc	297

*50 mg. of ester per kg. of potatoes equals 1.36 grams per bushel.

EXPERIMENT — 1943 - 1944

In September, 1943 freshly harvested Katahdin potatoes were treated with a dust preparation (talc) carrying the methyl ester. As a comparison Katahdin potatoes were treated with paper towel strips on which the ester had been deposited. All the potatoes were then stored in a home basement in baskets that had been lined with newspapers. In February, 5 months after the beginning of the experiment, the potatoes were removed from the baskets, desprouted and weighed. During this period the untreated potatoes produced sprouts at the rate of 1896 grams per bushel. Those potatoes which were treated with the ester deposited on paper towels and used at the rate of 50 mgs. of the ester per kg. of potatoes produced 327 grams of sprouts, whereas the potatoes treated with the ester, deposited on talc at the rate of 50 and 25 mgs. per kg., produced 47 and 297 grams of sprouts, respectively. In this test 25 mgs. of ester applied as a dust was equal to 50 mgs. of the ester applied on paper strips and distributed throughout the potato pack.

TUBER INJURY

Denny reports that in one experiment from 5 to 19 per cent of the potatoes that received an alpha-naphthaleneacetic methyl ester treatment after their dormant period had terminated, showed an unusual type of injury. The symptoms observed consisted of hard lump-like growths in the potato tissue, usually at the apical end. Affected tissue becomes dark on aging.

This same type of injury was reported by Thomas and Riker and was observed in a test on cobbler potatoes in New Jersey. It may be

significant that in each of the three cases reported, where injury resulted from the treatment with the ester, that the potatoes had passed their dormant period before treatment.

Effect on Germination

Because many of the sprouts that developed on potatoes that had been treated with alpha-naphthaleneacetic methyl ester, appeared very similar to the abnormal sprouts that we have called "blind sprouts," producd in occasional fields, some of the treated potatoes were cut into seed pieces and later planted. This was done to determine whether or not "blind sprout," as it occurs in the field, could be produced in this manner. The treated seed pieces germinated very poorly,—even after two months duration.

Conclusions

Alpha-naphthaleneacetic methyl ester successfully inhibited sprouting on the Katahdin and Cobbler varieties of potatoes.

The above mentioned ester was more effective when applied as a dust, than when distributed throughout the potato pack on paper strips.

From these experiments it appears that from ⅔ to 1⅓ grams of the ester should be used (on a dust) for the treatment of each bushel of potatoes. The amount to be used may vary somewhat with the temperature at which the potatoes are stored.

Injury followed the use of the methyl ester in one test.

Potatoes to be used as seed should not be treated with alpha-naphthaleneacetic methyl ester.

Literature Cited

1. Daines, R. H. and C. H. Nissley. 1943. Home storage of fresh fruits and vegetables. N. J. Agr. Exp. Sta. Circ. 460.
2. Denny, F .E. 1942. The use of methyl ester of alpha-napthaleneacetic acid for inhibiting sprouting of potato tubers and an estimate of the amount of chemical retained by tubers. Contrib. Boyce Thompson Inst. 12:387-403.
3. ————, John D. Guthrie, and N. C. Thornton. 1942. Effect of the vapor of the methyl ester of alpha-naphthaleneacetic acid on the sprouting and the sugar content of potato tubers. Contrib. Boyce Thompson Inst. 12:253-268.
4. Guthrie, John D. 1938. Effect of ethylene thiocyanohydrin, ethyl carbylamine and indoleacetic acid on sprouting of potato tubers. Contrib. Boyce Thompson Inst. 9:265-272.
5. ————. 1938. Inducing "dormancy" in potato tubers with potassium naphthaleneacetate and breaking it with ethylene chlorhydrin. Sci. 88:86.
6. Thomas J. E. and A. J. Riker. 1945. Sprouting of potatoes inhibited by plant hormones. Amer. Potato Jour. Vol. 22; (4): 104-113.