All of these treatments were applied four times during August to late string and lima beans. All treatments were successful in controlling the Mexican bean beetle, and no burning of foliage resulted from any of them. The spray treatment protected the plants longer than either of the dusts. There was no apparent difference between the arsenical dust and the fluosilicate dust except a slight difference in yield in favor of the magnesium arsenate. This was not necessarily significant, as the experiment was not run accurately enough for such comparisons.

Growers used calcium arsenate both as a spray and as a dust with good results. They also used proprietary dusts containing copper, lime and lead or calcium arsenate with good results. Lead arsenate was used alone and with lime and in Bordeaux mixture by some growers. In a majority of cases, injury resulted.

Summary

The Mexican bean beetle is well established throughout Connecticut.

Two complete generations appeared in the State during 1931.

The first generation required an average time of 33 to 35 days for egg to adult development. The second generation averaged from 36 to 39 days.

Larval development on cowpeas and *Dolichos lablab* was considerably slower than on other host plants.

The common varieties of beans were seriously injured. The Broad Windsor bean is the only immune variety grown in Connecticut.

Magnesium arsenate as a spray was the most satisfactory control. This material and barium fluosilicate used as dusts were equally effective.

TESTS WITH ARSENICALS ON BEANS FOR THE CONTROL OF THE MEXICAN BEAN BEETLE

By H. C. Huckett, *Riverhead, N. Y.*

Abstract

An attempt is made to appraise the comparative value of a few of the arsenicals when used in spray and dust mixtures for the control of the Mexican bean beetle (*Epilachna corrupta*), as indicated by the comparative safety wherewith such mixtures may be applied to beans. Magnesium arsenate and basic lead arsenate gave the most reliable results, but for eastern growers these arsenicals are comparatively expensive and are not readily procurable. Tests with calcium arsenate, which is comparatively cheap and easily procurable, showed that this insecticide might be used with comparative safety when combined with a copper-lime dust, bordeaux mixture, or a heavy hydrated lime spray.

During 1931 field tests were made on Long Island for the purpose of comparing the safety wherewith various arsenicals might be used in spray and dust mixtures for the control of the Mexican bean beetle.[1] Owing to the relative high cost of many of the more reliable arsenicals special emphasis was placed on the use of calcium arsenate (one brand only) in combination with hydrated lime spray mixtures in an effort to provide a satisfactory cheap mixture for general use.

The arsenicals tested showed the following analyses:

Acid lead arsenate	
Total arsenic pentoxide (As_2O_5)	30.0%
Arsenic in water soluble form, expressed as metallic arsenic, not more than	.5%
Basic lead arsenate	
Total arsenic pentoxide (As_2O_5)	20.0%
Arsenic in water soluble form, expressed as metallic arsenic	trace
Calcium arsenate	
Total arsenic pentoxide (As_2O_5)	40.0%
Arsenic in water soluble form, expressed as metallic arsenic, not more than	.5%
Zinc arsenite	
Total arsenious oxide (As_2O_3)	40.0%
Arsenic in water soluble form, expressed as arsenious oxide	.75%
Magnesium arsenate	
Total arsenic pentoxide (As_2O_5)	32.0%
Arsenic in water soluble form, expressed as metallic arsenic, not more than	.23%

TESTS ON LIMA BEANS. Bush lima beans were sown on June 3 in six series of plats, each of which consisted of fourteen 33-foot rows. Seven of these rows in each series were devoted to the testing of various arsenicals, five being treated and two left as checks.

Each series was sprayed or dusted with a basic preparation which served as a sticker or distributor for the poison, except of course in the case of the untreated check rows. Series 1 was sprayed with kayso-water, series 2 with goulac[2]-water, series 3 with bordeaux mixture, series 4 was dusted with copper-lime mixture, series 5 with hydrated lime when the leaves were moist, series 6 with hydrated lime when the leaves were dry.

Six applications were made, namely on July 3–4, July 16, August 5, August 10–11, August 15, 17, and on September 4 respectively. The spray mixtures were applied by hand at the average rate of 200 gallons per acre, and the dust mixtures by hand at the average rate of 40 pounds per acre.

[1]*Epilachna corrupta* Muls. [2]Powdered lignin pitch.

TABLE 1. THE COMPARATIVE WEIGHTS OF PODS AND VINES OF BEANS SPRAYED SIX TIMES WITH ARSENICAL MIXTURES

Arsenical ingredient	Weight of pods per row Spray mixture				Average weight per plant Spray mixture			
	Kayso-water	Goulac-water	Bordeaux mixture	Average	Kayso-water	Goulac-water	Bordeaux mixture	Average
	gms.	*gms.*	*gms.*	*gms.*	*gms.*	*gms.*	*gms.*	*gms.*
Acid lead arsenate.	11	2,638	3,290	1,979	73	130	217	140
Basic lead arsenate	8,546	9,969	11,166	9,893	308	330	324	320
Calcium arsenate. .	3,472	7,087	12,059	7,839	160	192	300	217
Zinc arsenite......	4,304	3,211	7,484	4,999	226	188	320	244
Magnesium arsenate	12,456	8,961	18,915	13,444	404	325	509	412
None............	6,546	8,784	11,206	8,845	296	376	310	327
Untreated checks.	12,386	8,179	12,616	11,060	400	332	397	376

The formulae used for the various spray and dust mixtures were as follows:

Arsenical 3 lbs., Kayso or Goulac 3 lbs., water 100 gallons
Arsenical 3 lbs., Bordeaux mixture (4. 6. 50) 100 gallons
Arsenical 1 lb., hydrated lime 4 lbs.
Arsenical 1 lb., Monohydrated copper sulfate 15 } 4 lbs.
Hydrated lime 85 }

The bean beetle was prevalent throughout the summer, and injury to the foliage of untreated rows was conspicuous but in no case was it very evident that the yield of beans or growth of plants was thereby affected. Two pickings were made on August 25 and October 19 respectively. The plants were weighed individually from October 19 to 23, a period of comparative inactivity.

The results are given in Tables 1 and 2.

TABLE 2. THE COMPARATIVE WEIGHTS OF PODS AND VINES OF BEANS DUSTED SIX TIMES WITH ARSENICAL MIXTURES

Arsenical ingredient	Weight of pods per row Dust mixture				Average weight per plant Dust mixture			
	Hydrated lime plants moist	Hydrated lime plants dry	Copper-lime	Average	Hydrated lime plants moist	Hydrated lime plants dry	Copper-lime	Average
	gms.	gms.	gms.	gms.	gms.	gms.	gms.	gms.
Acid lead arsenate	1,703	1,942	4,489	2,711	56	100	205	120
Basic lead arsenate	5,107	6,785	10,907	7,599	189	167	270	208
Calcium arsenate	1,520	3,803	9,601	4,974	82	54	241	125
Zinc arsenite	7,903	5,056	10,287	7,748	272	134	312	239
Magnesium arsenate	9,254	8,281	10,010	9,181	241	174	292	235
None	7,456	4,167	13,531	8,384	179	114	272	188
Untreated checks	9,494	6,862	9,443	8,599	312	187	253	250

The most noteworthy features of the above data are the consistently good showing of magnesium arsenate and basic lead arsenate, and the invariable effect of bordeaux mixture in enhancing the value of all arsenical mixtures. This is particularly true in the case of calcium arsenate, where the standard attained permitted of a satisfactory comparison with the more reliable but more costly arsenical mixtures.

In the case of dust mixtures magnesium arsenate was again the most consistently satisfactory arsenical tested. Zinc arsenite and basic lead arsenate averaged slightly lower results owing evidently to their inferior showing with hydrated lime dusts. On the other hand copper-lime dust served in a conspicuous manner to improve the results with all arsenicals. In the cases of basic lead arsenate, zinc arsenite, and calcium arsenate, the level attained was quite satisfactory. With hydrated lime mixtures, dusting the plants when dry invariably resulted in a relatively higher yield than when the plants were dusted moist with dew.

TESTS ON STRING BEANS. The purpose of the experiment with string beans was to ascertain what effect, if any, spray mixtures containing various proportions of hydrated lime had in lessening the extent of plant injury caused by the use of calcium arsenate.

Beans were planted on July 18 and August 8 in rows thirty-three feet in length. Each planting consisted of eight rows, three of which were sprayed by hand with mixtures of hydrated lime and water, and three others with bordeaux mixture of differing lime content. In addition, calcium arsenate was included in each of the above spray mixtures and was applied to only one-half of each treated row.

The spray formulae were as follows:

Calcium arsenate 3 lbs	Calcium arsenate 3 lbs.
Hydrated lime 3, 6, or 9 lbs.	Bordeaux mixture 100 gallons
	(4.6.50)
Water 100 gallons	(4.9.50)
	(4.12.50)

The mixtures were applied 4 times in the case of the earlier planted series, namely on August 12, August 18, August 28, and September 10, and in the case of the later planted series 3 times on the three later dates respectively. The rate of application averaged 200 gallons per acre.

Injury by the Mexican bean beetle was generally prevalent, and evidently in this case caused a slight decrease in yield in those sections not sprayed with calcium arsenate. The results should be interpreted with this in mind and should not be considered unreservedly as due to the effect of hydrated lime in lessening arsenical injury.

The results are given in Table 3.

TABLE 3. COMPARATIVE YIELD OF BEANS FROM PLOTS SPRAYED WITH MIXTURES CONTAINING VARIOUS PROPORTIONS OF HYDRATED LIME

Spray mixture	Test 1 (calcium arsenate added to spray) gms.	2 gms.	Average gms.	Test 1 (no arsenical added to spray) gms.	2 gms.	Average gms.
Hydrated lime 3–100	3,579	4,579	4,079	2,676	2,605	2,640
6–100	3,957	4,710	4.334	2,902	2,818	2,860
9–100	4,276	4,910	4,593	3,983	2,931	3,457
Bordeaux mixture 4.6.50	5,513	5,321	5,417	3,807	3,221	3.514
4.9.50	3,940	4,447	4,194	2,825	2,718	2,771
4.12.50	3,594	4,076	3,835	2,802	2,031	2,416
Untreated checks	3,210	3,752	3,481	2,955	2,155	2,555

The most significant feature of the results given above is in the fact that the yields were increased in the case of hydrated lime sprays according to the increase in the lime content, whilst in the case of bordeaux mixture the yields were gradually decreased according to the increase in the lime content of the spray. The highest yields were obtained in the rows sprayed with bordeaux mixture prepared according to the standard formula, 4.6.50.

Undoubtedly there is a tendency for more copper to remain on the leaves and flowers when applied by means of a spray mixture containing increased quantities of hydrated lime, with the evident result that the decrease in yield from plants sprayed with such mixtures may be due to an increased amount of copper residue on the plant. On the other hand the above data indicate that in the case of calcium arsenate and hydrated lime an increase of spray residue on the plant from such a cause did not have a harmful effect.

Summary

Magnesium arsenate was the safest arsenical added to spray and dust mixtures for the control of the Mexican bean beetle, at the same time it was one of the most expensive. Basic lead arsenate came next from the point of view of safety to plant growth, but the material is no longer readily available for the eastern grower.

Zinc arsenite and calcium arsenate gave inferior results except when used with copper-lime treatments. Bordeaux mixture and copper-lime dust served to lessen in a high degree the harmful effects of arsenical compounds, and in the case of calcium arsenate, the most generally used and cheapest of all arsenicals for truck crops, made it possible to use this material with some assurance of success.

OBSERVATIONS ON THE POTATO TUBER MOTH

By George S. Langford and Ernest N. Cory, *University of Maryland, College Park, Md.*

Abstract

On three occasions during the past nine years the potato tuber moth (*Phthorimaea operculella*) has caused economic losses to potato growers in Worcester and Somerset Counties. During two years, 1925 and 1930, the damage was serious. In 1929 it was slight. Temperature is an important factor regulating the rate of growth in all stages of the insect. Outbreaks coincide remarkably with certain climatic factors. Hot and dry years seem to be most favorable for development. Every year in which the insect has been abundant the temperatures during the growing season were far in excess of the normal, and the rainfall below the normal. This combination of factors was outstanding for the months April to July. Calculations based on the number of day degrees required for development indicate that years in which the tuber moth occurred there was a sufficient accumulation of day degrees to make possible an additional brood of the insect. The intensity of the infestations in a given area appears to vary in proportion to the amount of rainfall.