Hon. Mr. BUCHANAN: Are there any weather conditions that might arise and help to destroy the grasshoppers?

Dr. BARTON: Yes. I shall be coming to that shortly, sir. First may I refer to the estimated cost of control for 1934? It is as follows: Manitoba, $95,000; Saskatchewan, $500,000 and Alberta, $125,000, a total of $720,000. That looks like a lot of money. But at a conference held in the United States, atended by Canadian representatives, a recommendation was made that the sum of $2,000,000 be requested for coping with the grasshopper situation in the United States. So far as I can learn their territory is no more extensive than ours, if it is as extensive, but we feel that we are perhaps a little better organized than they and therefore can do the work for relatively less money.

The CHAIRMAN: Who bears the cost of the control?

Dr. BARTON: The province pays for the bait, and the municipalities arrange for the mixing of the bait. The federal service, through the Entomological Branch and also through the Experimental Farm Branch, provides a staff for organizing, directing, and working with the provincial people. The cost of the campaign in 1933 was $95,000, of which sum $60,000 was paid by the province and $35,000 by the municipalities. The estimated savings were 34,800,000 bushels of all grains, with an estimated value of $15,944,750.

Answering the question of Senator Buchanan, I will now refer to the relation between the weather and grasshopper outbreaks. These outbreaks usually take place after a series of dry, warm years. The interplay is about like this. A warm season is usually a dry one. The warm season allows the eggs to hatch early and the young hoppers to develop very rapidly and reach maturity early in July. As a great proportion of the grasshoppers live till the first frosts, the early maturity gives a prolonged period for egg laying. As a consequence, the grasshoppers are enabled in a warm dry summer to lay several times as many eggs as in a year when the weather is cool and the periods of activity are curtailed by cloudy or rainy weather. In addition, the fact should be recognized that moist weather is favourable to the development of fungus diseases of grasshoppers which may, if conditions are suitable for their development, completely sweep off the grasshopper population upon very large areas, hundreds of square miles.

Grasshoppers are normally held in check by natural conditions. In the ordinary year the interplay of warm and cool weather, sunshine and rain, disease, parasites and predators prevents them from becoming abundant enough to injure crops seriously. However, a dry warm year or two allows the grasshoppers to increase rapidly and out-strip the various factors tending to keep them down, and if the dry period continues as during the last five years, a prolonged destructive wide spread outbreak results.

As a rule the outbreaks would eventually be terminated by nature. Some times it is simply weather, the dry warm years being followed by a cool year or two. On other occasions it has been a warm but moist year which has so promoted fungus diseases that the grasshoppers as virtually to bring the outbreak to an end. In others, where the weather was more or less normal and not definitely promoting grasshopper increase, the natural insect parasites normally present and attacking the grasshoppers simply increased to a point where they reduced the grasshoppers to a status below outbreak numbers. As a rule all factors operate together to some extent, and eventually bring about a reduction of numbers below the point of economic importance. This process, however, may take one, two or three years, and meanwhile several crops may be ruined. Hence the necessity of protecting the crop by what look like expensive campaigns. The protection of the crop is so easily possible and the benefits of control effort so direct and profitable that popular support for the work in any locality where an outbreak is threatened or in existence is virtually unanimous.