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Is there a pay-off for basic research on leafy spurge?

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Leafy spurge is a deep-rooted perennial plant that contains a white, milky latex. It can readily invade and occupy a variety of ecological niches, but is most troublesome on low value (and I use this term loosely) rangeland, pasture land, and recreational land. What I have just briefly described is the nature of leafy spurge and some of the potential problems associated with its control.

Once the problem is defined, we try to find successful and economical control solutions by chemical, cultural, and biological means. If the control measures are not successful or economical, and our attempts to find a quick, cheap, and easy control method fail, then we must change our strategy and determine why the plant survives all our attempts to kill it. This is where we must "bite the bullet" and conduct the basic science studies on the specific mechanisms which allow the plant to evade and survive control measures and also do research to discover the weak links in the plant that may be broken in some practical and economical manner. Here is where research on the physiology and biochemistry of the plant fits in.

The theme of today's session "The Pay-off for Five Years of Leafy Spurge Research." My talk, in particular, is to address the question, is there a pay-off from basic research on leafy spurge? To put the efforts on basic research of leafy spurge in context with the other areas that have been funded during the past 5 years, I have to say that the applied chemical and cultural research programs, awareness programs, and the biological control programs have received the lion's share of the funding, but nevertheless, there has been a pay-off from the basic and applied physiological and biochemical studies on the leafy spurge plant itself and the herbicidal chemicals used in an attempt to control that plant.

What are some of the things we have accomplished?

Initial field observations show that different leafy spurge biotypes have differential sensitivity to herbicides. After these observations, some laboratory studies have been conducted on the uptake, translocation, metabolism, and mode of action of the herbicides. These studies provide the type of information that will help us use the herbicides in the most effective manner possible and these studies also in a somewhat indirect fashion help us understand the physiology of the leafy spurge plants.

Based on many years of field experiments with various herbicides, Lym and Messer from NDSU published this widely used figure that depicts the sensitivity of leafy spurge to three herbicides throughout the season. Various laboratory researchers have conducted studies on the herbicides and the plants to help explain this figure. Since the bottom line on the sensitivity of leafy spurge to herbicide is "will the herbicide effect root buds?" we are doing research on the root buds to determine why they remain inactive and what biochemical changes must take place before the buds will grow and draw the lethal herbicides to them.

A unique feature of the leafy spurge plant is its white, milky latex. The latex contains massive amounts of starch, a potential food source for the plant. Past work by laboratory researchers has shown that this food source is not useable by several members of the Euphorbiacae family of which leafy spurge is a member. Scott Nissen, my research assistant, has shown that the starch in the latex of leafy spurge is apparently not used even when the plant is under light starvation conditions. Just like you and me a plant does not do something for nothing. So I pose the question then; why is leafy spurge putting so much effort and energy into the production of food that it cannot use? We don't know. My gut feeling is this could be a weak link in the plant that may be exploited and it warrants considerably more attention.

The last area I'm going to talk about today is the work Bruce Maxwell, a graduate student of Pete Fay's, began several years ago under my supervision. The fundamental reason why leafy spurge is not controlled by chemicals, and may not be successfully controlled by biological agents in the future, is that it possesses a very deep and hearty root system that has numerous buds that serve as a survival mechanism when the plant is under attack. When the plant is attacked by chemicals, sheep, or potential biological control agents, the dormant buds begin growing and re-establish the top of the plant. Hence, the infestation reoccurs and flourishes. Until we deal with and understand root bud dormancy, which is the fundamental reason for the poor control of leafy spurge, we will, in all probability, have no basis for its management. What I just said is that until we understand the problem, in all likelihood, we will not solve the problem.

Now let's move into some of Bruce Maxwell's work on root bud dormancy in leafy spurge by posing this question: "Can we make all dormant buds grow?" If we could make all dormant buds grow, we may be able to deplete the food reserve in the root and kill all the emerged shoots with some chemical or cultural treatment. The answer to the question is maybe, and here's why. Early field observations by Fay and Maxwell indicated that Roundup herbicide made the shoots of leafy spurge grow prolifically. We call this witch's brooming. Upon further observation it was discovered that the buds on the crown of the plant were released from dormancy and also were growing prolifically in response to the Roundup application. In digging deeper we found that some of the dormant buds deeper on the root system were being released from dormancy and were growing. I believe this research, in part, validates the notion that we may be able to induce leafy spurge root bud growth. Then, when all the food reserve has been used and many stems are present, we can attack the plant and dramatically increase our chance of controlling the infestation.

I have to add a word of caution. Roundup does not control leafy spurge. At present, Roundup is simply a novel laboratory chemical that can be used to study dormancy in

leafy spurge. What I have just shown you has no immediate practical application in the field but it does demonstrate that the potential exists to control the plant once we have learned more about the fundamental problem associated with the plant and that problem is root bud dormancy.

I pose the next question: “Will we accomplish more in the next 5 years?” I am not going to answer this question optimistically or pessimistically. I will answer it very frankly and realistically. Each physiologist, given his or her individual talent, creativity, and hard work, will accomplish all that is possible. But sufficient money that is now not available must be provided to fund this critically important research. In essence, those that are concerned with finding control solutions for leafy spurge and that hold the purse strings will ultimately answer this question.