

## Fresh-Market Cabbage: Increasing Economic Returns While Reducing Risk

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### Overview

Crucifer crops (cabbage, broccoli and cauliflower) continue to be important vegetable crops for Midwestern U.S. growers, for both processing and fresh market.



Cabbage looper and damage

Annually, ≈750 acres of cabbage and related crucifer crops are produced in Minnesota for fresh-market (grocers, farmer's markets, and roadside stands). Despite the relatively low acreage, the high value of the crop (≈\$4000/acre), and traditionally high insecticide use of as many as seven applications per season, continue to create a demand for alternative insect management programs.

In Minnesota, and throughout much of the U.S., cabbage is attacked by three Lepidopteran (larval) pests, including the cabbage looper, imported cabbageworm, and diamondback moth. However, since 1990 the cabbage looper has become the most dominant and difficult pest to manage. Because of high insecticide use, we developed a research-based Integrated Pest Management (IPM) program that is based upon timely pest monitoring, the use of action thresholds to determine when pest control is needed, and reduced-risk insecticides to conserve natural enemies (e.g., insect predators) of multiple insect pests.

### IPM Approach

The purpose of this study was to conduct an "IPM Pilot Test" of a Cabbage IPM Program with a large fresh-market grower in Minnesota to assess the economic value and risk of IPM. The pilot test was based on previous research conducted at the University of Minnesota Outreach and Research center (UMORE Park) that confirmed the efficacy of new reduced-risk insecticides (e.g., SpinTor®, Avaunt®), and the use of



an action threshold based on the percentage of plants infested with cabbage looper larvae (i.e., rapid presence/absence sampling). A key aspect of this approach was that reduced-risk insecticides were used early in the season to conserve beneficial natural enemies (predators and parasites), to provide additional biological control, and to prevent "aphid flare-ups." The use of pyrethroids (e.g., Warrior®) was limited to late-season sprays when pest population pressure increased and protection of cabbage heads became critical.

When cabbage looper was present, an action threshold of 10% of the plants infested with larvae was used. However, when only diamondback moth and/or imported cabbageworm were present, an action threshold of 50% of the plants infested with larvae, until heading, was used; a 10% larval infestation from heading to harvest was used for late-season crop protection. The IPM program was compared with the grower's standard pest control practice which may or may not include pest monitoring. Since few growers were willing to quickly adopt the new IPM approach on a large scale, the IPM Pilot Test was conducted from 1998-2001 using six commercial fields provided by Pahl's Farms, and as part of an On-farm, 100-ac, Private-Public Sector Partnership developed at UMORE Park.

### RESULTS

#### Economic Value and Risk of IPM vs Conventional Programs

For all four years, the IPM-based program resulted in increased net returns compared to the Conventional and No pest control (do nothing) programs (**Table 1, Fig. 1**). Benefits provided by IPM were due to several factors. On average, the IPM program increased marketable yield >10% and decreased the number of insecticide applications by 23%. Net returns for IPM were also higher despite the increased cost of pest monitoring (\$12/ac; no monitoring costs were included for conventional). The IPM program increased net returns by \$401/acre, compared with the conventional program (**Table 1**); i.e., net returns from IPM were 6.3X higher than that of the conventional program. In addition, the standard deviation (risk) of net returns was only about ½ of that for the conventional program. The standard deviation (SD) is a common measure of economic risk, reflecting the volatility

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or variability in net returns. As with all agricultural crops, there are many factors that influence the variability in pest pressure, final yields and produce quality. One of the goals of IPM is to reduce the SD of net returns. As a statistical term, the SD refers to 68% of the possible distribution of net returns. For example, for IPM, the SD

of \$393 indicates that 68% of the time the expected net return of \$476/ac should fall between \$83 and \$870/ac. The higher SD for the Conventional program (\$692/ac), indicates greater volatility, with expected net return (\$75/ac) ranging from \$-617 to \$767/ac.

**Table 1. Expected Net Returns and Risk (\$/acre) for various cabbage pest management strategies**

Pest Management Strategy	Average Return (Net Revenue) <sup>1</sup>	Risk (Standard Deviation) <sup>1</sup>
IPM	476	393
Conventional	75	692
No Pest Control	-1422	1246

<sup>1</sup> Expected net return and risk (standard deviation, SD) calculated according to expected utility theory as provided in the formula of Hutchison et al. (2004); see text for tactical differences between IPM and Conventional systems.

In addition to the expected average return and risk, probability analysis of the 4-year data set indicated the IPM program always had the highest probability of achieving any particular net return goal (**Fig. 1**). These results clearly illustrate the value of the IPM program compared to the conventional grower program. From an economic perspective, the results also indicate that an

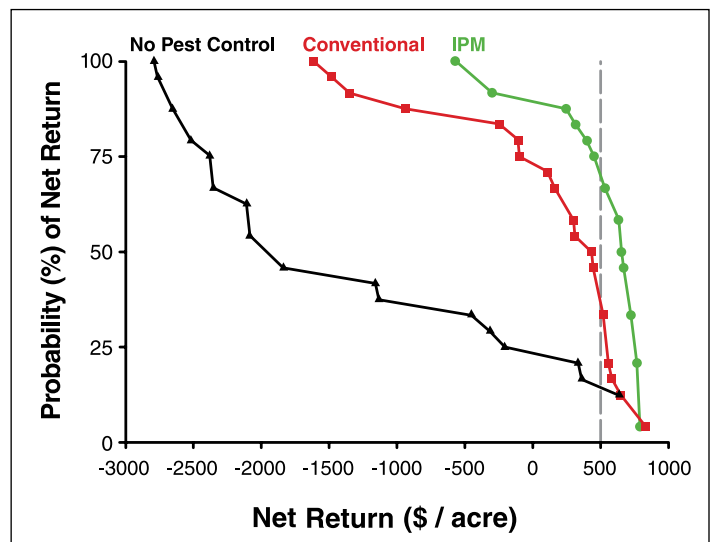
IPM program for Lepidopteran pests in Midwestern U.S. cabbage should be an attractive incentive to many growers, regardless of whether they view themselves as risk-averse or risk-takers. In addition to economic goals, the environmental benefits and costs for this IPM program could also be evaluated.

**Fig. 1.** Probability (chance) of a Midwest U.S. grower achieving various net returns using different pest management programs. The dashed line indicates that the probability of achieving a profit of \$500/acre is 70% for IPM, 38% for conventional, and 14% if no pest control is used (4 year study: 1998-2001).

**Further reading:**

Hutchison, W.D. et al. (2004). Integrating novel technologies for cabbage IPM in the USA: Value of on-farm research, pp. 371-379. *In Proc. 4th International Workshop on the Management of Diamondback Moth*, Nov. 2001, Melbourne, Australia.

Hines, R. C. and W. D. Hutchison. (2001). Evaluation of action thresholds and spinosad for Lepidopteran pest management in Minnesota cabbage. *J. Econ. Entomol.* 94: 190-196.



**DISCLAIMER**

Reference to products in this publication is not intended to be an endorsement to the exclusion of others. Any person using products listed in this publication assumes full responsibility for their use in accordance with current manufacturer directions.

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