WEED CONTROL DECISION-MAKING - AN EXPERT SYSTEM APPROACH

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Abstract.   Farmers and non-specialist advisers have to cope with continually increasing amounts of information about the weather, new prices and costs, new crop varieties and new agrochemical products. They often seek help from weed experts to sift and use the information to plan effective weed control strategies. Weed experts are in great demand and short supply, resulting in costly delays to the farmer during peak periods.

An expert system or computer-based consultant can help disseminate the expertise, ensuring that weed control advice is timely, reliable and cost-effective. Expert systems are computer programs that attempt to solve problems and provide advice in a manner akin to a human expert. They also support their decisions by explaining their reasoning to the user and can therefore gain the confidence of the user and/or train the user. A few groups are currently adopting expert systems technology to solve problems of an agricultural nature (1, 2, 3).

The W.A. Department of Agriculture is developing an expert system (WEED - WEEd aDviser) to aid non-specialist advisers in the selection of control strategies of weeds in field crops. WEED will be developed in a series of steps. This incremental approach means that we can use feedback from the system to refine it to ensure that responses match those of the expert. The knowledge base which contains weed control information will be constructed by deriving knowledge from weed experts and written sources. The knowledge can be embodied in an expert system in the form of facts and rules. For example, the knowledge base can incorporate rules of the form IF condition THEN action, such as:

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IF      weed = ryegrass and crop = wheat and strategy = post-emergence
THEN    output 'Recommend chemical 'x' for post-emergence control of
        ryegrass in wheat'.
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How and when such rules are used to 'reason about' the problem depends on the set of heuristics (informal or imprecise rules derived from human experience) contained in the inference engine. The inference engine decides how and when to apply specific rules in an attempt to mimic the expert's line of reasoning. For example, before the above rule can be applied the following heuristic must be used to add the fact that the optimum time for applying herbicide is post-emergence:

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IF      previous crop = wheat
THEN    strategy = post emergence
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During later stages of development the credibility and performance of the system will be verified using a number of test cases.

The technology of expert systems should have a major impact on weed control decision-making in the future. It is hoped that ideas of the type outlined may prompt others to consider an expert system approach to solving practical problems of a diagnostic or educational nature.

REFERENCES

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