

No German Hops for Beer without Insecticides or Fungicides

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Hops are a specialty crop used for bittering and flavoring beer. Germany ranks number one in worldwide production of hops producing about one-third of the world's supply. Two-thirds of Germany's hops are exported.

Hops in Germany are attacked by two key pests requiring annual treatment to all acres: the hop aphid and the two-spotted spider mite. In addition, 100% of German hop acreage is treated with fungicides targeted at downy mildew and powdery mildew.

Aphids feed directly on hop plants, extracting cell sap and nutrients with their sucking mouthparts. Hop aphids excrete prolific amounts of honeydew. Sooty mold grows on the honeydew and can destroy a crop's value, as mold renders hop cones unacceptable for brewing [1]. Spider mites puncture leaf tissue and destroy leaf cells while sucking plant juices from the leaves. Mites feed on and damage cones, which dry, turn red and shatter. Red or discolored hops produce off-flavors and are unmarketable.

The downy mildew fungus first appears in the spring as an infected shoot. The under surface of the leaves becomes blackened with millions of spores which spread the disease to other shoots. The cone becomes brown and is unacceptable to brewers. In the severest of attacks downy mildew can result in total loss of the crop. The fungus causing hop powdery mildew only attacks hops. Powdery mildew infections lead to browning of hop cones, which changes the aroma of the cones making them unusable for brewers. Powdery mildew first became serious in Germany in 1972 and has annually been the target of fungicide sprays ever since [2].

Spraying to control aphids and spider mites in hop yards in Germany was already carried out in the 1800s with soap, tobacco extract and nicotine. These products gave unsatisfactory control so that harvest failures frequently resulted [1]. Downy mildew appeared for the first time in Germany in 1923. Hop production declined by 50% [3]. Germany ceased to export hops and became an importer due to the yield reductions [4]. In 1929, the conclusion was reached that because of downy mildew, hops could no longer be grown in Germany without regular applications of fungicides [5]. By 1931, production returned to a surplus, enabling hops to be exported again [4]. Major improvements in controlling spider mites, aphids and downy mildew came about with the introduction of synthetic chemical fungicides and insecticides in the late 1940s[1].

References

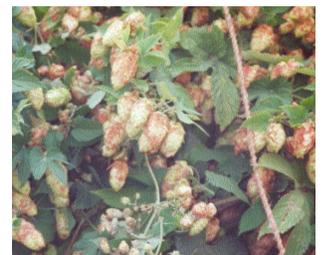
1. Kolbe, W. 1966. Studies on the control of aphids and spider mites on hops. *Pflanzenschutz-Nachrichten*. 19(4):189-242.
2. Royle, D.J. 1978. Powdery Mildew of the Hop. In *The Powdery Mildews*. D.M. Spencer, Ed. Academic Press. London.
3. Royle, D.J. and H. TH. Kremheller. 1981. Downy Mildew of the Hop. In *The Downy Mildews*. D.M. Spencer, Ed. Academic Press. London.
4. Cramer, H.H. 1967. Plant protection and world crop production. *Pflanzenschutz-Nachrichten*. 20(1):5.
5. Salmon, E.S. 1920. The downy mildew problem in Germany. *The Brewers' Journal*. March 5:155.



Aphid damage on hop at right



Hop aphids



Red hops from powdery mildew



Downy mildew on hops



Powdery mildew on cones and leaves