EFFICACY EVALUATION OF HERBICIDES, FUNGICIDES AND INSECTICIDES IN FINLAND 2011

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Internet: The trial report is available also at www.mtt.fi/plantprotection

GENERAL REMARKS ON EXPERIMENTAL CONDITIONS AND OBJECTIVES

Weather conditions

The growing season 2011 was exceptionally warm, and after midsummer also exceptionally rainy. There were no late spring frosts or early autumn frosts. The full weather data from Jokioinen, Piikkiö and Ylistaro are included in the Appendix 6.

Main activities

The results from 14 herbicide trials, 2 trials with plant growth regulators, 5 fungicide trials and 2 insecticide trials conducted in 2011 are presented in this report. Most of the trials were based on research agreements with companies. The results of these trials have been reported directly to the clients. The results from 20 herbicide trials, 35 fungicide trials and 13 insecticide trials are excluded from this report as confidential. Most of the field trials were located in the fields of MTT Agrifood Research Finland in Jokioinen and Ylistaro, some also in Oulu area, Piikkiö and Mikkeli. Some trials were conducted in the fields of private farmers.

Herbicides tested

The efficacy and the selectivity of Sekator OD and Oxitril CM in different mixtures were compared with those of some other herbicides in barley. The usefulness of Attribut Super and Broadway was researched in controlling couch grass and broad-leaved weeds in wheat. Puma Extra and Axial 50 EC were tested in mixtures with some herbicides against wild oat in very demanding conditions. Two plant growth regulators Cycocel 750 and Terpal were evaluated in oat and spring wheat. Wild oat control strategies with Clamox in Clearfield spring turnip rape were tested in one trial. The selectivity of Galera in spring turnip rape was studied in two trials. Goltix 70 WG was tested in two harvest year trials in caraway, and the subsequent effects of several other herbicides applied in the sowing year of caraway were studied. Also weed control strategies in direct-sown caraway were compared. Information on the tested herbicide products used in the trials is given in the Appendix 7a.

Fungicides tested

The results of three spray trials carried out to evaluate the efficacy of fungicides against leaf diseases in cereals are included in this report. These trials were comparison trials with the fungicides on the market in Finland in 2011. Net blotch (Pyrenophora teres), powdery mildew (Erysiphe graminis hordei) and scald (Rhychosporium secalis) were the main diseases in the barley trials. In the wheat trial no diseases were detected. The efficacy of the seed treatment fungicides on the market in Finland in 2011 was tested against diseases in spring barley. Net blotch (Pyrenophora teres), spot blotch (Cochliobolus sativus) and loose smut (Ustilago nuda f. sp. hordei) was found in the trial. The efficacy of fungicide Prosaro against Sclerotinia disease (Sclerotinia sclerotiorum) in turnip rape was studied in one trial. Information on fungicide products used in the trials is given in the Appendix 7b.

Insecticides tested

There were two field trials in this report, where efficacy of insecticides on carrot and caraway was studied. The efficacy of Coragen 20 SC, Plenum WG, Biscaya OD 240 and Movento SC 100 were compared with Karate 2.5WG against carrot psyllid (Trioza apicalis) on carrot. All treatments were tested as a foliar spraying with the
volume rate 200 l/ha. The sprayings were made three times (BDF) with the test treatments and six times (ABCDEF) with the reference treatment Karate 2.5 WG. The efficacy of insecticide Karate 2.5 WG at five different timings was evaluated against caraway moth (Depressaria daucella) on caraway in one trial. Information on insecticide products used in the trials is given in the Appendix 7c.

STRUCTURE OF THE REPORT

Agricultural Research Manager (ARM) -software (by Gylling Data Management, USA) has been used for data processing, statistical analysis and making of graphs in GEP-trials. The trial report consists mainly of the Agricultural Research Manager printouts, added with some sheets made with word processor. The reports of each individual field trial consist of the following data sheets:

1. **Summary**
   - a short verbal summary of the purpose and the main results of the trials with figures

2. **Trial Treatments**
   - trial treatments as a table
   - table column headers indicate:
     * Trt No = treatment number
     * Treatment Name = trade names and active ingredients of the products in the treatment
     * Form Conc = the total amount of active ingredients in the product g/kg or g/l
     * Form Type = code of the formulation type of the product
     * Lot Code = lot (batch) number of the product sample
     * Rate = the rates of products and active ingredients
     * Rate Unit = rate units of products and active ingredients
     * Appl Code = timings of the applications: A = first application, B = second application etc.

3. **Site Description**
   - information on trial location, crop species, establishing, study design, soil type, application etc.
   - the extended BBCH scale (see appendix 5a) and the crop growth stages for cereals (see appendix 5b) are used in expressing the growth stages of the crops and the weeds.

4. **AOV Means Table**
   - trial results presented as a table of treatment means
   - assessments are described in the column headings with standard codes:
     * EPPO codes are used as names of crops, weeds, diseases and pests
     * rating dates and treatment-evaluation intervals are included
     * full explanations of the data transformation formulas (in the column heading ‘ARM Action Codes’) are shown below the data tables and the codes are explained further in appendix 3
     * normally, the data is presented with multiple comparison tests
     * relative values for main assessments are shown under the data values in parenthesis

The multiple comparisons of the treatment means are based on the Student-Newman-Keuls test. The treatment mean values indicated with different letters differ statistically significantly (p<0.05) from each other. The Bartlett’s test has been used to test the homogeneity of variance of the assessment data. An asterisk (*) after the Bartlett’s P-value indicates, that the data of the column violates the assumption of homogeneity of variance. Typically that happens, when the treatment means of the untreated treatment differ a lot from the means of the other treatments. For that kind of data the analysis of variance and the multiple comparisons test are not valid. If necessary, square root (SQR(x+0.5), log (LOG(x+1) or arcsine square root percent transformations have been made for some data columns. If the Bartlett’s test shows the original data to be heterogeneous (there is an asterisk after the Bartlett’s P-value), the multiple comparisons test of the transformed data is valid instead of the test of the original data.

When possible there has been made an ARM summary across trials from the results. The summary tables are presented after the data tables of the individual trials.
GENERAL TRIAL INFORMATION

Good Experimental Practice

All the field trials were conducted according to the GEP-standards (GEP = Good Experimental Practice) and relevant EPPO guidelines were applied to the trials.

Setup of field trials

Full information on the setup of each individual trial is included in the Trial Treatments and Site Description data sheets of the trial reports. Randomised block design with 4 replicates was used in most of the trials. The plot size varied normally between 10 m² and 24 m² depending on the crop and machinery available.

The machinery used in the establishing of the trials varied depending on the trial site. In the private farms, normal farm machinery was used. In the fields of MTT the seed-sown field crops were sown with a combine fertilizer-sowing machine, which placed the fertilizer under the seedbed. For the seed dressing trials and the fungicide trials with turnip rape and oilseed rape the fertilizer was drilled in soil before sowing or planting.

Usually, the first treatment in a trial is the untreated control followed by one (or more) reference product(s).

The spray applications of the products were made with a portable, compressed air-powered "van der Weij"-type sprayer boom length 2 – 3 m, mounted with a wind shield and Hardi flat-fan nozzles (types 4110-12/16/20, 4665-20 and LD015-110). The spraying pressure was 1.9 – 2.8 bar depending on the nozzle type and the boom length. The liquid seed treatments were made with a Hege 11 liquid seed dresser and the dry seed treatments by rotating seeds in a glass jar.

The seed yield of field crops was harvested with a trial plot combiner. The grain yield was dried and cleaned after the harvest. The grain yield, 1000 seed weight and hectolitre weight of cereals have been transformed to 15 % moisture content and those of turnip rape, oilseed rape and caraway to 9 % moisture. The yield of the horticultural and vegetable crops was harvested by hand. The harvested area per plot was normally in field crops 10-20 m² and in horticultural crops 4-8 m².

Assessments information in herbicide trials

The weed assessments were normally made by sampling the weeds about 3-8 weeks after the last herbicide application. The sample size in weed assessments was usually 2 x 0.5 m² per plot, sometimes 2 x 0.25 m² per plot. The number and the air-dry weight of weeds were recorded.

Visual assessments on phytotoxicity or on vigour of the crop, effect on special weed species etc. are given on relative scale: 0 - 100 (0 = untreated control or in vigour 100 = untreated control).

Assessments information in fungicide trials

Cereals

In the foliar fungicide trials in cereals the incidence of leaf diseases was assessed on plot basis. The NIAB assessment key for cereal foliar diseases was used for the disease scales (see in Appendix 8). The first assessment was done just before the first spray application and 3-4 week thereafter. The greening effect was assessed by counting the average number of green leaves per plant.

In the seed treatment trials the speed of emergence was estimated 1-3 days after the first seedlings emerged above soil with a subjective assessment of the crop stand (STASUB) by comparing the size and amount of emerged seedlings in treated plots to the untreated (101) plot with a scale 0-3. The emergence was assessed when 2-3 leaves were unfolded (BBCH crop stage 12-15) by counting plants from 4 x 2 row meters in each plot, which is equal to one square metre. At the same time there were counted also the amount of the seed borne net blotch.

For the seed borne spot blotch assessment a sample of 40 plants was collected from each spring barley plot at the beginning of stem elongation. Sub-samples of 10 plants were taken from the second, fourth, seventh and ninth row diagonally through the plots. Stems and roots of the plants were rinsed with water and the symptoms assessed. The plants were divided to five groups according to the severity of the symptoms and a disease index was calculated from the number of plants in different groups.
DISEASE INDEX = ((B+2C+3D+4E)*100) / (4*(A+B+C+D+E)).
Group A = no symptoms
Group B = small spot on coleoptile
Group C = more attack on coleoptile and some on roots, healthy plants
Group D = severe attack on coleoptile and roots, plants depressed
Group E = dead plants.

The barley loose smut (Ustilago nuda f.sp hordei) was assessed from the same seed treatment trial by collecting and counting the number of infected ears in each plot two times after heading.

Tumip rape and oilseed rape

The incidence of the Sclerotinia disease (Sclerotinia sclerotiorum) on turnip rape was assessed from the plots by counting the diseased plants at the beginning of ripening (BBCH 80-85). The disease incidence was assessed from five plants of 10 randomly selected sites in each plot (50 plants / plot). The outer rows of the plots and about one metre band at both ends of the plot were excluded from the assessments.

The 50 plants of each plot were classed with the following scale from EPPO Guideline PP 1/80(2):
Healthy = no infection
<25% = light attack (parts of side-shoots or whole small side-shoots attacked, including attacks at their point of insertion on the stem, but not more than 25 % of the whole plant)
25-50% = moderate attack (larger side-shoots attacked, including their points of insertion on the stem, but not more than 50 % of the whole plant)
>50% = severe attack (plant more than 50 % attacked or completely killed).

The oilseed rape and turnip rape yields were harvested with a plot combiner. Before cleaning, one sample (70 g) of the seed yield was taken per plot and the number of sclerotia per sample was counted. The results are presented as a number of sclerotia per 500 grams of seeds. The grain yield and the 1000 seed weight were transformed to 9 % moisture content.

Assessments information in insecticide trials

Carrot

Control of carrot psyllid (Trioza apicalis)

In the trials I-11-061-06 on carrot there were two sampling time, 29th June and 20th July. In both samplings 800 grams of carrot leaves were taken randomly from each plot. The samples were frozen until they were assessed. During the laboratory assessments leaves were crashed, mixed, filtered and finally 5 grams of each sample was analysed. In the analyses the numbers of eggs, larvae and adults of carrot psyllids were count.

RESEARCH STAFF

Pentti Ruutunen was the head of the testing unit. The study directors in fungicide trials were Ulla Heinonen, Asko Hannukka and Marja Jalli. The study director in insecticide trials was Jarmo Ketola. The study directors in herbicide trials were Sanni Junnila and Pentti Ruutunen. The responsible study technicians in Jokioinen were Matti Eskola, Leena Holkeri, Niko Jalava, Auli Kedonperä, Päivi Koski, Anne Muotila, Kirsi-Marja Palm, Kirsi Puisto, Eeva Reiman, Tellervo Ruoho, Leena Ruokonen, Aila Sirén, Eira-Maija Tanni, Hilkka Timonen, Senja Tuominen, Tuula Viljanen and Timo Väätäinen.

Merja Högnäsbacka and Tapio Kujala in Ylistaro, Marja Kujala in Pirkko, Szuszsanna Galambosi and Reijo Pesonen in Mikkeli and Lea Hiltunen, Anu Kankaala, Osmo Leiviskä and Tapio Uotila in Ruukki were responsible for carrying out the field trials at these trial sites.

Jokioinen, January 27th 2012

Pentti Ruutunen Sanni Junnila Jarmo Ketola Ulla Heinonen