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Developing a participatory approach to seed production and varietal selection

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Summary

The performance of UK winter wheat varieties was tested under organic conditions involving farmer participation. Three breadmaking varieties (Hereward, Solstice and Xi19) and their mixture (1:1:1) were grown at 19 UK farms in 2003/04 and 2004/05. The variability of productivity on organic farms was illustrated with more variation among farm sites than among varieties. Seed health was generally high over all sites. Although the trials were successful, more time was needed at project initiation to improve farmer involvement. Some farmers expected more researcher visits, and were reticent about assessing the trials themselves. In contrast, some participants valued the variety performance data on their farms particularly when related to that of other growers. The balance between the goals of the researchers relative to the farmers needs to be defined at project initiation.

Key words: Organic farming, winter wheat, varieties, mixtures, seed borne disease, participatory research

Introduction

The UK Recommended Lists of cereals (Anon., 2006) is the source of comparative information about cereal varieties. However, these lists relate only to crops grown conventionally with the 'untreated yields' only referring to an absence of fungicides; information about variety characters important in organic production is omitted; and data for varietal mixtures is absent, the use of which may be advantageous in organic systems (Wolfe, 2001). A number of recent organic variety trials conducted over a limited range of sites has shown that the variety ranking varies depending upon farm (Taylor & Cormack, 2001). To produce meaningful data on organically grown varieties, a participatory methodology was developed to better understand variety testing with farmers. The diversity of trial sites also permitted an examination of any relationship between organic husbandry and incidence of disease, and the risk of seed-saving. Farmer participation has proved useful in solving problems in diverse farming systems, characteristics typical of organic farming.

Methodology

Seed (25 kg) of the varieties Hereward, Solstice, Xi19 and their mixture (1:1:1) was sent to 19 UK farmers across the UK (East to West England) in September 2003 and 2004. Farmers were either existing contacts of EFRC, or had shown interest in the project at open days. Most farmers participated in both years, but not all farms were the same and different fields were used between years. Seed was drilled (plots average 125 m^2) using the farmer's standard methodology within a wheat field. Researchers gained information from each farmer about their farming system, the trial field and the trial both by telephone and written questionnaires. The farmers were interviewed pre-harvest to determine their views of the trial, experimental activities and learning methods.

At crop growth stage 92 (Zadoks *et al*., 1974), four measurements for weed incidence, crop height and ear numbers were taken and ears were cut from four sets of 1 m^2 for each variety. Grain yield, thousand grain weight (TGW), specific weight, protein content and Hagberg Falling Number (HFN) were determined. Seed borne disease tests were done for each sample at NIAB.

Results

Grain yields

The average yield in 2004/05 (5.60 t ha^{-1}) was higher than in 2003/04 (3.9 t ha^{-1}). Yield results for both years showed significant ($P < 0.05$) site by variety interactions. However, yield variation among sites was much larger than the difference between varieties in both seasons. This variability in yield was a result of both system and site level interactions.

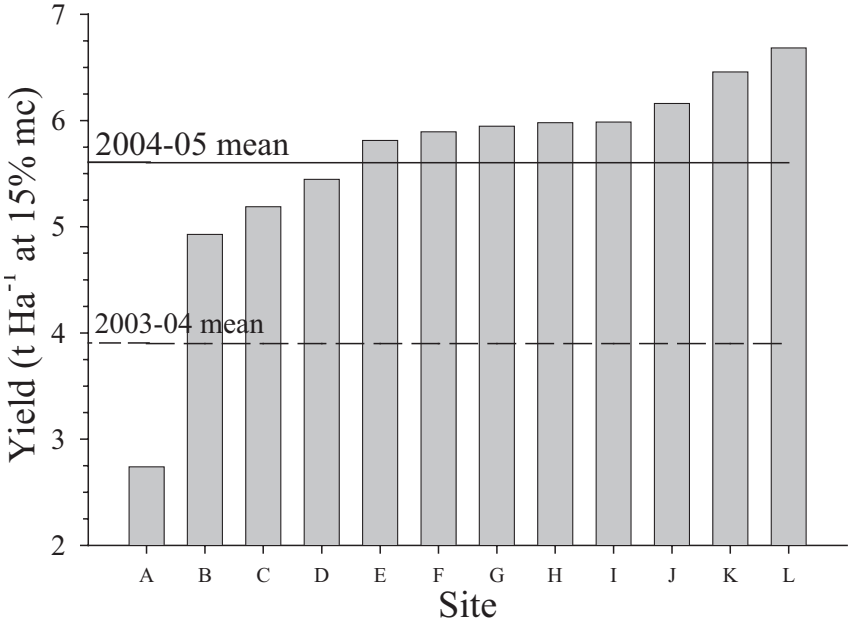

Fig. 1. Average 2004/05 yields of the three varieties and the mixture at each site (SED = 0.31, df = 18) and the means of yield (2004/05 and 2003/04).

Growth habit

The results from 2003/04 revealed an East-West split across the country; the wheat in the west was shorter but higher yielding compared to the taller and lower yielding wheat in the East. In contrast, in 2004/05 the wheat grown on the western sites was significantly ($P < 0.001$) taller than those in the east (77.6 cm and 70.1 cm in the west and east, respectively SED = 0.380, df = 140), although the differences weren't as large as in 2003/04. The eastern sites had an average lower

yield, but this was due to the low yields at site A (Fig. 1).

Grain quality

Although there were no significant differences among the HFN of the varieties in either year, on average HFNs were higher in 2004/05 than the previous season. The low HFN results in 2003/04 can be attributed to the wet summer which caused grains to sprout and HFNs to drop.

The average protein was lower in 2004/05 than 2003/04. However, if the protein harvested per hectare is calculated, protein yield per hectare increased by 16% (0.06 t ha^{-1}) between 2003/04 and 2004/05; the carbohydrate in the grain increased by a greater proportion (47%). Therefore, the weather affected the carbohydrate production of the crop more than the protein production because the latter is more dependent on available nitrogen. Most of the varieties in 2004/05 achieved the milling requirement for HFN (> 250 s) and all made the requirement for specific weight (> 76 kg/H^{-1}); an improvement on the previous season. However, none of the varieties met the protein level required for a milling premium (> 13%) in either season.

Seed borne diseases

Seed borne diseases did not occur at higher levels in organic production; the health status of all seed was generally good across all sites and varieties.

Farmers' views

a) The variety performance data from many trials under different conditions was considered useful but some commented that even the extended trial set that was used did not cover adequately the wide range of variables that can be expected.

b) Farmers were requested to assess plots using set criteria, but there was a reticence to complete these assessments. Farmers requested more researcher involvement, which raises the questions of the farmers' understanding of the participatory approach (or the ability of the researchers to explain it).

c) Farmers appreciated the comparisons of the apparent variety performance (from visual appearance) and the data from assessments; farmers considered it a useful lesson. The variability also helped farmers to appreciate the problems involved in trying to incorporate further new varieties into successive trials.

Interviews with farmers, by necessity, were carried out at harvest. Better feedback could have been achieved when farmers were less busy, or at farm walks and research institutions, which were considered by farmers to be valuable for business information. However, the turnout for this type of event was poor.

Researchers' views

A number of farmers requested trial results prior to drilling in the subsequent year; a rapid turnaround of data is necessary to ensure the information is of greatest value to the grower.

Conclusions

It is possible to meet most quality requirements for milling under organic conditions, but achieving protein quality is difficult. The level of seed borne diseases across the farms showed that seed health status was generally high.

The trials demonstrated the large variability of organic farming systems and the difficulty in selecting a suitable variety. The greater variability in yield and grain quality amongst field sites than amongst varieties, and their mixtures, suggests that the genetic background of the varieties tested was too narrow to buffer the climate variability between the farms. All varieties proved similarly plastic in their environmental response in that, in 2003–04, the trials grouped into short,

high yielding in the west and tall, low yielding in the east. This tended to be the reverse in 2004–05, but, again, all varieties and the mixture responded in the same way.

The participation of farmers in research ensures that the outputs are of relevance, helping to solve practical problems in diverse farming systems, characteristics typical of organic farming. The level of participation can vary however (Biggs, 1995) depending upon the research objectives, and partner expectations.

The research methodology that has been used was clearly researcher led. Farmers did not feel an ownership of the project, since many participants drilled the crops to do project partners a 'favour'; were disappointed in the relative contribution of researchers; and expected a 'standard' trial design at each site. However, farmers did value the data obtained, which also provided a reference for their own farming systems relative to other organic farms across the country. The solution is firstly, to spend more time in introducing the project and its objectives and in discussing and developing the trial design. Secondly, it is important to recognise and recruit farmers, and researchers, who have a high willingness to participate. Initial meetings should ensure that a common understanding is reached between farmers and social and field scientists; these meetings should take place at an off-peak time of year. However, the project did develop a useful set of working relationships (farmer-researcher; farmer-farmer and researcher-researcher) which should be exploited in further project development.

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