IMPROVING WHEAT YIELDS - A COMPARISON

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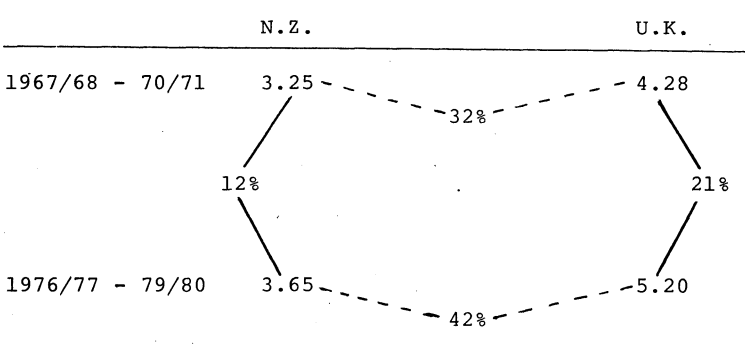
It has been pointed out that over the last 20 years the wheat yields achieved in the United Kingdom have steadily increased, while the New Zealand average yield has remained virtually static.

If we look specifically at the last 10 years, we see that while New Zealand average wheat yields have increased by about 12%, United Kingdom yields have increased by 21%. This has led to the United Kingdom average wheat yield being at present, 42% higher than ours.

TABLE 1. INCREASE IN AVERAGE WHEAT YIELDS OVER LAST 10 YEARS (t/ha)



Much of the increase in the United Kingdom average wheat yields is a direct result of conditions facing the United Kingdom farmer 10 years ago, and the actions produced as a result. Ten years ago United Kingdom wheat growers were facing conditions similar to those facing New Zealand wheat growers now - increasing yields and prices for wheat had failed to keep pace with increasing costs, and profit margins had become low.

THE ENGLISH APPROACH

I was fortunate in spending the 1978/79 year in the United Kingdom, and was able to study first hand their farmers approach to this problem.

The approach to solving this low profit margin problem was two fold:-

Plant Breeding Programme and Recommended Varieties

An intensive plant breeding programme was initiated to produce varieties capable of high yields. The first variety released in this programme was Maris Huntsman in 1972. Although since superceded, Maris Huntsman was the first variety with the potential of producing the magical 10 tonnes per hectare. Since then, about 20 new varieties have been released for United Kingdom farmers, at the rate of two or three each year. Many of these varieties were bred and released on a regional basis. Now their Advisory Services produce an annual 'recommended variety list', stating the current top 10 varieties for each region, scoring each variety according to yield, grain quality and weight, straw length, disease resistance, and so on.

TABLE 2. RECOMMENDED VARIETIES OF WINTER WHEAT FOR SCOTLAND 1979

	Grain Yield as % of Average
Stuart	105
Mardler	104
Aquila	103
Sentry	103
Armada	100
Kinsman	99
Maris Huntsman	96
Flanders	95
Boquet	95

Others have pointed out that these high yielding United Kingdom varieties are basically low quality feed wheats. While accepting this fact it must be pointed out that the best of their bread wheats still yield considerably higher than our varieties, and the fact that here in New Zealand 10 tonnes per hectare has already been achieved at acceptable milling standards indicates there is a great unrealised potential in our own existing bread wheat varieties.

I feel it is this unrealised potential in our own varieties on which New Zealand growers must concentrate.

Blueprint of Husbandry Factors

The second approach to the problem in the United Kingdom was to draw up a blueprint of husbandry factors designed

to determine the components of yield and management of most importance to maximising yield. I must emphasise that this was not designed to be a rigid recipe for growers to follow. It was merely an attempt to draw all the fractionated research into an overall management package, out of which it was hoped that with experience and trials they could determine the husbandry ingredients that were essential for a high yield, and those which were flexible and could be altered according to locality, season, variety and so on.

The initial blueprint involved a system of high inputs of seed, fertiliser and chemicals, with pests and diseases being sprayed for on a preventative basis, regardless of whether they eventuated. It was a costly system, and although it achieved high yields, it often did not increase profit margins. But as more and more information became available from within the blueprint system, and more grey areas were ironed out, progress was made towards a final management package.

MANAGEMENT PACKAGES

The final management package which evolved from this initial blueprint involves following a few essential principles, sets some crop component targets to be aimed for, and relies on a high level of management and continued crop surveillance to manipulate both the crop and the more flexible inputs.

The basic principles to be followed in the United Kingdom are:-

* Good early establishment of the correct plant

population.

* Feed the crop according to its stage of growth (nitrogen).

* Keep the crop green, and free of pests and diseases.

* Ensure efficient application of all inputs (timing, amount, method).

* Ensure efficient harvesting, drying and storage.

* Check the crop regularly, and make the appropriate management decisions.

Involved in these principles is the desire to achieve a few basic targets.

* 300 plants per square metre, established post winter (in practice this has been 200 - 350, with the greater flexibility enabled by the use of nitrogen to manipulate tillering. The climate is also such that more tertiary tillers can survive and develop good ears than is the case in New Zealand).

* 600 ears per square metre present at harvest (this is a minimum, with the range being 600 - 800).

* 40 grains per ear harvested.

* 42 gram thousand grain seed weight.

A combination of these principles and target figures has produced a management package adopted by growers of high yielding crops in the United Kingdom.

Let me now comment on the husbandry practices which make up these management packages.

Establishment

Aim to establish 300 plants per square metre post winter, assuming a 67% field establishment, and with the sowing rate determined from the thousand grain seed weight. The objective is to develop and feed the correct number of plants, each with two or three good strong tillers, which will have a greater probability of survival and development to large ears. The German Schleiswig-Holstein system, which aims for a plant population of around 400 plants/square metre, and the Belgium Laloux system, which aims for 150 - 200 plants/square metre, followed by heavy early applications of nitrogen to boost tillering, have both been proved less economic than the United Kingdom system in Great Britain.

The crop should be sown early - before mid October in the United Kingdom which would seem to equate to late April-early May in Canterbury - with an expected nine percent reduction in yield from delaying sowing by one month.

If such yield advantages were conferred to New Zealand growers, they would easily pay for any costs associated with aphid control to contain Barley Yellow Dwarf Virus.

Drilling should be carried out slowly, into a firm, even rubbly seedbed, with precision drilling giving the best

TABLE 3. EFFECT OF SOWING DATE ON YIELD

	Date	*Yield t/ha*
Earliest 25%	1 October	7.2
Next 25%	9 October	6.9
Next 25%	17 October	6.8
Latest 25%	3 November	6.5

(Source: "Pointers to Profitable Wheat - Towards A Ten Tonne Crop, 1979" Survey conducted by ICI of 10,000 hectares of Wheat in England)

results. There has been shown to be no sigificant long term yield difference between tradtional cultivation, minimum cultivation, and direct drilling, therefore the choice of method has been based on other factors, such as economics, time, soil type, and farmer preference. Within these various techniques, many of the 'fine-tuning' points have been evolved, such as the advantage to burning stubble before direct drilling.

TABLE 4. EFFECT OF STRAW DISPOSAL ON DIRECT DRILLED CROPS

Method of Straw Disposal	*Wheat Grain Yield t/ha*
Baled	6.0
Poor burn	6.2
Good burn	7.1

(Source: "Pointers to Profitable Wheat - Towards A Ten Tonne Crop, 1979")

The basic soil fertility should be good, in terms of phos-

phate and potash. Nitrogen is not required at sowing for autumn crops unless drilling follows a very wet summer/autumn, or a depletive crop.

Seed should be heavy, high germination, high vigour, and treated with a systemic fungicide, such as "baytan" or "vita-flow".

Feeding

Applications of nitrogen should be varied according to previous cropping history, rainfall, plant population and stage of growth. It is considered that 200 kg of nitrogen per hectare is about optimum quantity of nitrogen to give a good yield without too much disease and lodging. Some of this will be supplied from the soil, and the rest applied as fertiliser.

First applications of nitrogen are recommended at G.S. 2 - 3 of an average 60 kg nitrogen per hectare being used to manipulate tillering according to the plant population, with a second application at G.S. 4 - 6, of about 80 kg nitrogen per hectare. Two applications of nitrogen have almost always outproduced a single application.

Some farmers give a third application just prior to ear emergence, at G.S. 10, but this appears to have debatable economic value. Most nitrogen is applied in the liquid form.

Cycocel

Almost all top growers use Cycocel, a chemical straw shortener. Growers who use it can show a 15 - 20% yield

increase over those who do not use it. This yield increase is not, however, due to the Cycocel itself, but due to it giving the growers the confidence to use higher rates of nitrogen, without fear of lodging. It also gives some control over eyespot. It restricts the height of the average variety to around knee height or 60 cms.

Weeds, Pests and Diseases

Contrary to the initial blueprint, this whole area is now left flexible, and the general recommendation is to treat as and when necessary.

The underlying message is that nitrogen will only be effectively used if the crop is free from competition from weeds, pests and diseases and free from moisture stress. In other words keep the crop green and clean.

With weeds, autumn control with a spring follow-up if necessary is considered better than total spring control.

Pest and disease control relies on close surveillance of the growing crop, and taking the correct action at the first sign of trouble. I was impressed to see big growers in the United Kingdom paying technical representatives $10/ha to walk all their crops weekly, and initiate the control measures required. The emphasis is obviously on attention to detail. Most crops would receive at least one disease control spray, and usually more.

Many growers use liquid nitrogen so they can use a tank mixed cocktail of nitrogen, cycocel and a disease spray such as Bayleton.

It was evident that growers could 'look knowingly' at their crops and recognise all the common pests and diseases, and were fully familiar with the various growth stages of the crop.

Tramlines

With often as many as six passes over a crop in the spring, many farmers have adopted the use of tramlines. This is where wheel marks are left in the crop by blocking off appropriate drill coulters, or spraying after emergence. Subsequent passes with tractors follow these wheel marks, and the distance between sets of wheel marks is designed to suit the width of spray booms and fertiliser spreaders.

The procedure is designed to increase the efficiency of application of nitrogen and chemicals, and speed up these operations, as well as avoiding second growth from wheel marks.

Surveys show a seven to eight percent yield advantage to tramlining, which is more likely due to the increased efficiency of nitrogen and chemical applications, than the reduction to second growth.

Irrigation

In those areas of the United Kingdom where irrigation is considered an advantage, water is usually applied at G.S. 9 - 10, and again for grain fill. The second irrigation is considered as important as the first, in order to give high grain weights, and good quality. This is obviously of increasing consequence in Canterbury also, where the incidence of high screenings is increasing, even with

irrigation, as yields are pushed well above those of the trials from which the early irrigation recommendations were made.

Harvesting

The key phases here are "prepare your gear", "take care", and "take your time".

SUMMARY

* Profit margins received by the average New Zealand wheat grower are low, and the only method an individual farmer has to improve his profit margin is to improve his yield; he must ensure he is an above average grower.

* We need to follow a similar pathway of district blueprinting and subsequently manipulating the components of crop yield in order to arrive at flexible management packages suitable for New Zealand growers in their respective districts. Some of the trial data necessary to draw up these blueprints is not available in this country, so I feel we must look at overseas data and attempt to extrapolate it to our conditions.

* Plant breeding must continue to develop quality wheats with the genetic potential to respond to higher levels of inputs, and with regional suitability.

* More research needs to be carried out with wheat, as indeed with all crops, on a complete 'management package' basis, rather than individual

husbandry components. This has been under way in the United Kingdom for 10 years, and on the Continent for 15 years, and I do not see why it should take so long for proven techniques to be adopted here.

* New Zealand wheat growers must be prepared to increase their inputs to the wheat crop, where it has been proved to be economic, and accept that the traditional 'low-cost production crop' is, in most areas, already a thing of the past.

* Farmer, advisers, technical agents, and all others associated with growing wheat must learn to understand the wheat crop and its growth, and give the crop the attention to detail necessary to achieve a high yield.