Research Report

HDC

FV 56

WELL_N: The user friendly Nitrogen advisory model for on-farm use

Final report 1991/94

Working for

HORTICULTURAL DEVELOPMENT COUNCIL

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Final Report 17 May 1994

Project Number:	FV 56:C186
Project Title:	WELL_N: The user friendly Nitrogen advisory model for on-farm use.
Project Leader:	Ann Draycott
Location of project:	HRI Wellesbourne
Project Coordinator:	A Whitlock
Date project commenced:	April 91
Date project completed:	April 94
Key Words:	Field vegetables/cereals/Nitrogen/Soil/Leaching/ environment/simulation/computer model/monitor

RELEVANCE TO GROWERS AND PRACTICAL APPLICATION

Application

An easy to use advisory model has been developed to forecast fertiliser-N requirements of 24 different field crops. Nitrogen requirement can be predicted from data collected before planting and can be re-assessed during growth as more information becomes available. The model which is now available from HDC has been field tested by twenty growers and advisors who used it to prepare advice for over 3000 ha of commercially grown vegetable crops.

Scope and objective of the project

Fertilisers have a decisive influence on crop production and on environmental pollution. Requirements vary greatly from crop to crop and field to field in ways that are difficult to predict. Current UK fertiliser recommendations for vegetables rely heavily on early work carried out at HRI, in which static mathematical models (incorporating information about amounts of soil and fertiliser N and the responsiveness of the crop) were calibrated against data from field experiments both at Wellesbourne and on a few crops throughout the country. The main limitation of this approach is that the recommendations are somewhat inflexible, as allowance is made for only three separate categories or indices of soil N status and little account is taken of differences in climatic conditions in different regions of the country.

In practice N fertiliser requirements depend on a whole range of factors including depth of rooting, mineralisation rate, crop residues, time of planting, expected yield and the amount of mineral N in the soil at the start of the growing season, and it is seldom that any one of them is of overriding importance. Some means is needed for taking account of all these factors when making a recommendation. Research has shown that many of the key processes influencing N response are governed by simple widely applicable equations. These have been "packaged" in complex computer simulation models for forecasting the effects of changes in soil and plant N on crop response. The validity of these models have been tested against the results of numerous field experiments both in this country and in mainland Europe, and agreement between prediction and experiment has generally been very good (Refs 1-11). However these models were devised for research purposes and they require data inputs that are not readily available to growers.

The objective of the present work has been to convert these research models into ones that can be easily used by growers and their advisors with inputs readily available to them to provide a more reliable and flexible basis for fertiliser practice.

Summary of results

A menu driven suite of programs known as WELL_N has been written to enable growers to optimise N-fertiliser practices for 24 different field crops, including major arable crops such as potatoes, sugar beet and wheat. WELL_N is quick and easily to use requiring input data readily available to growers. The model will allow better account to be taken of the region, soil conditions, crop debris, local weather and past cultural practice in forecasting fertiliser N requirements.

There are two complimentary models within WELL_N. The first **Response model** uses data gathered before or at planting to give a N-fertiliser recommendation prior to growth. In addition the model displays the expected yields, crop nitrogen content, soil mineral N and cumulative leaching at harvest and throughout the growing season, with different N-fertiliser rates. The second **Updating model** enables extra information gained during growth to be used to re-assess the need for nitrogen top dressing and provide information on irrigation need as well as estimates of soil mineral N, leaching and plant yield.

The **Updating model** will automatically be used once extra information gathered during growth is entered into the dataset ensuring account is taken of all available data.

Any of the following may be collected at intervals and used to improve predictions:-

Local weather
Soil mineral N
Soil moisture deficit
Plant dry weight t/ha
%N of plant dry matter
Application of additional N fertiliser
Application of additional irrigation

Output from this model for the selected regime includes tables with the timing and amounts of N-fertiliser and irrigation needed to maintain near maximum growth rate plus plant yield and N uptake, soil mineral N and cumulative leaching both at harvest and throughout growth. This allows close monitoring of crop growth and any imbalances between nitrogen supply and demand to be quickly noticed and rectified.

Action points for growers

Copies of the computer model for use on IBM compatible PCs, DOS version 3.3 or later, at special discount to members are available from:

Mary Bosley
HDC
18 Lavant Street
Petersfield
Hampshire GU32 3RW

Telephone: 0730 263736.

(A PC with a maths coprocessor is recommended to speed model runs, but is not essential)

Practical and financial anticipated benefits

N-fertiliser advice in the past only accounted for a few of the many factors influencing N-requirements. WELL_N enables account to be taken of more of the these factors and the

results of extensive tests against experimental data suggests it should prove a more reliable basis for advice. Use of the program should minimise the risk of crops suffering restricted yield from Nitrogen deficiency and at the same time reduce the risk of nitrate pollution.

WELL_N was demonstrated at the following meetings and shows

Members' Day, Wellesbourne	Mar 1992
Growers' meeting, Littlehampton	Jun 1992
Open Day, Wellesbourne	Jun 1992
Open Day, Kirton	Sep 1993
Wellesbourne Vegetable Research Association: Computer Modelling for Horticulture	Oct 1993
Workshop on nitrates	Nov 1993
Poster exhibit SCI meeting on Nitrogen Cycling within Vegetable rotations	Jan 1994
BGLA HRI & HDC stands	Jan 1994
NTV trade show - Amsterdam	Jan 1994
Grower Meeting at Pershore College	Feb 1994
HDC Brassica Day	Mar 1994

(In addition Drs I G Burns and C R Rahn have described the work in lectures and presentation to MAFF, scientists, advisors and growers)

Press coverage

Farmers Weekly	-	Mar 1992
Grower	-	Jun 1992
Farming News	-	Jul 1992
Birmingham Post BGLA edition	-	Jan 1994
Grower	-	Jan 1994
Radio Lincolnshire	-	Mar 1994

References

1. GREENWOOD D.J., DRAYCOTT ANN, LAST P.J. & DRAYCOTT A.P. (1984). A concise simulation model for interpreting N-fertilizer trials. *Fertilizer Research*, **5**, 355-369
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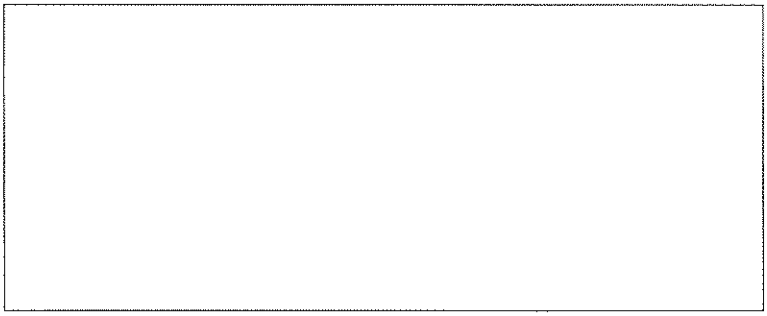

Working for Growers

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