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Scoping Study:

The Impact of CIMMYT Research on the UK Wheat Sector

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Summary of Findings

1. The specialised UK growing environment has caused the impact of CIMMYT wheat varieties in the UK to be slight. Conducting robust economic analysis of minor research influences is both difficult and open to criticisms of arbitrariness.
2. The IFPRI methodology¹ is not suited to measuring economic benefits from improvements in grain quality and disease resistance (refer to paragraphs 15 and 16). These are the most likely direct benefits which the UK has derived from CIMMYT wheat research.
3. The methodology is weak at dividing varietal yield improvement benefits between CIMMYT and national research programmes (refer to paragraphs 11 and 17).
4. A review of other, more appropriate methodologies would be important if ODA decides to proceed with the analysis of CIMMYT's research impact in the UK.

Anecdotal Evidence of the Impact of CIMMYT Wheat Research on the UK Wheat Sector.

5. Wheat breeders from four of the largest plant breeding companies in the UK (Nickerson Seeds, Plant Breeding International, Zeneca Seeds and New Farm Crops) were canvassed for their views on CIMMYT's research impact on the UK. The overall opinion was that the direct impact has been slight and may now be negligible. Salient points were as follows:

5.1. CIMMYT wheat varieties are not adapted to the unique UK growing environment. Consequently, their relevance is limited to their use as parent material in UK breeding programmes. Disease resistance and grain quality are the main CIMMYT varietal traits which UK breeders have tried to incorporate into their varieties.

5.2 CIMMYT varieties have had a greater impact on UK spring wheat than on winter wheat. Winter wheat is the major wheat crop in the UK.

5.3. Semidwarfism, the characteristic which has made a major impact on wheat yields throughout the world, was not introduced to UK breeding through CIMMYT. Instead, UK breeders used the original Norin 10 semidwarf variety directly from Japan. However, CIMMYT pioneered much of the early work into semidwarf germplasm and to some extent, proved its potential.

5.4. The biggest CIMMYT impact occurred during the eighties. CIMMYT variety CP300 was used as a parent for the Plant Breeding Institute variety "Moulin". Moulin had potential for high quality and high yields. However in practice, adverse British weather conditions caused low pollen production and hence plant sterility. Expected eight tonne yields translated into farm yields of just one tonne. As a consequence, many farmers faced bankruptcy. CP300 was singled out as the cause of the disaster.

¹ Contained in EPTD Working Paper No. 18. See References.

Moulin has since been extensively used as a parent for more successful varieties. The impact of CP300 is therefore still felt, although only as grandparent and great grandparent breeding material.

5.5. The impact of CIMMYT varieties in the UK is diminishing. UK breeders are increasingly relying on germplasm from other sources, especially from Eastern Europe. This trend will probably continue into the future.

5.6. In a marginal sense, the UK benefits indirectly from the CIMMYT research programme. CIMMYT is at the forefront of research into breeding techniques and plant biology. Advances in these fields are relevant to wheat breeding in the UK and throughout the world.

A brief review of the research impact methodology used in IFPRI, EPTD Working Paper No. 18

6. The IFPRI paper introduces the subject of US support to the CGIAR by considering a wide variety of benefits which accrue to the US from CGIAR research. Such benefits include greater global wealth, which leads to greater political stability, reduced immigration pressures and increased demand for US goods and services. The study then quickly narrows the focus of interest to a consideration of how CGIAR wheat and rice varieties have benefited US agriculture, either by the direct use of CG varieties in farmers' fields or the use of CG varieties in US plant breeding programmes. The methodology used for analysing each crop varies slightly. In view of ODA's exclusive interest in wheat, only the wheat methodology is reviewed here.

7. The IFPRI paper takes a pragmatic approach to measuring the impact CIMMYT wheat varieties in the US. Unfortunately, the authors do not give explicit descriptions of their methodology and consequently it is difficult to see how they deal with several crucial areas of the analysis.

8. The study starts by developing a crude estimate of the yield impact of all wheat research (both US and CIMMYT) on the US wheat sector between 1970 and 1993. The study uses both industry and experimental plot data to measure absolute wheat yield gains. Both types of data have their drawbacks. Experimental yield data is measured under standardised optimal growing conditions. The difference between experimental and farm yields can be significant. The use of industry yield data presents problems of standardisation. Differences in input quantity and quality (including management) occur between farms and over time. Consequently, at least some industry yield changes will result from factors other than improved wheat varieties.

9. Relative yearly yield gains are derived by subtracting base yields from absolute yield gains (weighted to reflect varietal usage in the US wheat sector). This is one of the areas where the paper's methodology is unclear, but it seems likely that the base is derived from a weighted yearly yield average of the varieties which were used at the beginning of the period (1970). Base yields will typically decline over the years because base varieties will lose their resistance to diseases. The IFPRI measure of

relative yield gain therefore captures the benefits of maintaining disease resistance at levels equivalent to earlier years.

10. Relative yield gains are valued at world prices (adjusted to real values) to remove price distortions created by domestic agricultural policies. The analysis then makes an adjustment for changes in input use by deducting changes in US wheat production variable costs (again, adjusted to real values).

11. The most contentious part of the IFPRI paper is the manner in which yield improvements are attributed to either US or CIMMYT breeding research. An analytical problem arises because some varieties have both US and CIMMYT parentage. The paper uses two methods to disentangle the influences, one which is described as “conservative”, and the other as likely to provide an “upper bound” to the CIMMYT share of benefits. The conservative method attributes half the benefits to the breeder of a variety, an eighth of the benefits to the breeders of the parents, 1/32 of the benefits to the breeders of the grandparents, and 1/64 of the benefits to the breeders of the great grandparents.

12. The “upper bound” method attributes all the benefits to CIMMYT if the variety has any CIMMYT parentage whatsoever. This method is clearly heavily biased in favour of CIMMYT.

13. The paper then considers US research costs for both US wheat breeding institutions and CIMMYT.

14. Both costs and benefits are discounted using a rate of 3%. Costs and benefits are totalled and put into a benefit cost ratio. Only the CIMMYT ratio is reported.

Critique of the methodology

15. The study ignores genetic improvements in grain quality and yield stability. Grain quality is particularly important in developed countries, where price premiums are available for higher grade grain.

16. While the study makes some attempt to adjust benefits for temporal changes in input use, the link between improved genetic disease resistance and reduced costs of disease control is not clearly made. Consequently, benefits from improved resistance are not fully catered for in the methodology.

17. To a large extent, the assumptions made in separating the relative influences of the various research programmes, determine the result of the analysis. An extreme example is the “upper bound” technique.

18. The discount rate of 3% is surprisingly low. No justification is made in the text.

19. Historical cost benefits are not reliable indicators of what benefits future research might yield. The IFPRI paper only considers past benefits. An analysis of likely future

benefits would have been useful if the aim of the study was to persuade the US government to continue supporting CGIAR research.

Requirements for an economic appraisal of CIMMYT's impact on the UK

20. A quantitative measurement of CIMMYT's impact will require the following:

20.1 A review of appropriate methodologies for separating research influences, and for measuring economic benefits from genetic improvements in grain quality and disease resistance.

20.2 Access to historical data on variety adoption in the UK, experimental yield, industry yield, the relationship between experimental and farm yields, input usage on UK cereal farms, world wheat prices, the parentage of UK wheat varieties, costs of UK wheat breeding research, and the breakdown of ODA funding to CIMMYT. The methodology review may reveal additional data requirements.

20.3 Time. At this stage, predicting the time requirement is very difficult. Ultimately, the answer depends on the depth of analysis which ODA may require. A rigorous approach will probably require months rather than weeks.

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