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Wardlaw I F. The effect of water stress on translocation in relation to photosynthesis and growth. I. Effect during grain development in wheat. *Aust. J. Biol. Sci.* 20:25-39, 1967.
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Grain growth and grain water content were found to be unaffected by a stress that resulted in several days of leaf wilting and reduced photosynthesis. ^{14}C-studies demonstrated that this reduction was associated with a greater channeling of photosynthate from the lower parts of the plant to the grain and that phloem transport was relatively insensitive to water stress. [The *SCI*® indicates that this paper has been cited in over 110 publications.]

Grain Growth and Translocation in Water-Stressed Wheat

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Plant-water relations was a topic receiving considerable attention in Australia in the 1960s, and Canberra was one of the main centres for this work. As a novice in this area, I quickly learnt the benefits that were to be gained from the use of growth chambers with humidity control in the Canberra phytotron, particularly after some preliminary studies without this control resulted in many unscheduled measurements during the day and night.

At the time this work was started, one of the gaps in our knowledge of water relations in plants was an understanding of how different processes in cells, tissues, and organs were integrated in their response to stress at the whole-plant level. It had been suggested that phloem transport, the mechanism of which was being strongly debated at the time, might be susceptible to water stress, although it now seems more likely that phloem transport will only respond to stress if there are gradients of water potential in the plant.[1] This early work on wheat provided strong evidence that the phloem was in fact competent to handle the required transfer of dry matter from the leaves to a growing organ (grain) under quite severe stress conditions. In a subsequent study,[2] published in 1969, it also became possible to demonstrate that for vegetative plants the effect of water stress on translocation was more apparent than real, resulting from a slowing of extension growth in leaves and roots before there was a reduction in photosynthesis. The flexibility of phloem transport under adverse conditions has now been confirmed in a range of plants and noted in several reviews.[3,4] The conclusion has been reached that long-distance transport, *per se*, does not appear to be an important factor in controlling growth.

This study on wheat also provided evidence for the stability of grain growth under water stress, a finding that was in agreement with field observations and has subsequently been studied in much more detail.[5,6]

I am not sure whether this paper has been cited more from the point of view of translocation or stress physiology in cereals, but I assume that its acceptance is related to its timing and a long-term, continuing interest in both these areas of research.

1. **Lang A & Thorpe M R.** Water potential, translocation and assimilate partitioning. *J. Exp. Bot.* 37:495-503, 1986. (Cited 5 times.)
2. **Wardlaw I F.** The effect of water stress on translocation in relation to photosynthesis and growth. II. Effect during leaf development in *Lolium temulentum*. *Aust. J. Biol. Sci.* 22:1-16, 1969. (Cited 80 times.)
3. **Milthorpe F L & Moorby J.** Vascular transport and its significance in plant growth. *Annu. Rev. Plant Physiol.* 20:117-38, 1969. (Cited 75 times.)
4. **Gifford R M & Evans L T.** Photosynthesis, carbon partitioning and yield. *Annu. Rev. Plant Physiol.* 32:485-509, 1981. (Cited 145 times.)
5. **Barlow E W R, Lee J W, Munns R & Smart M G.** Water relations of the developing wheat grain. *Aust. J. Plant Physiol.* 7:519-25, 1980. (Cited 30 times.)
6. **Jenner C F.** Transport of tritiated water and ^{14}C-labelled assimilate into grains of wheat. III. Diffusion of THO through the stalk. *Aust. J. Plant Physiol.* 12:595-607, 1985. (Cited 5 times.)

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