Table 1 *Aphid transmission of groundnut potyvirus isolates*

Name of aphids	SN isolate: No. of plants infected / No. of plants exposed	SN isolate: Per cent trans-mission	SM isolate: No. of plants infected / No. of plants exposed	SM isolate: Per cent trans-mission
Aphis craccivora (from cowpea)	7/60	11.6	5/40	12.5
A. gossypii	33/60	51.6	22/60	36.6
M. persicae	26/60	43.3	14/60	23.3
T. odinae	7/60	11.6	7/60	11.6

manner[4,5]. Short acquisition feeding period is a characteristic feature of non-persistent viruses[6]. *A. craccivora* from groundnut failed to transmit the 3 virus isolates, and the remaining aphids transmitted only SN and SM isolates but not NS isolate. The percent transmission of SN and SM isolates varied with aphids (table 1), decreasing with *A. gossypii, M. persicae, A. craccivora* and *T. odinae*. Thus SN and SM isolates can be considered as non-persistent viruses as they were acquired by aphids during 5 min feeding and transmitted them to the test plants without a latent period. None of these aphid vectors naturally infest groundnut crop. But still these non-colonizers can act as potential natural vectors of SN and SM isolates as alighting for short periods during their flights over groundnut crop may be sufficient for acquisition or inoculation of viruses. It would be worthwhile to examine the importance of the above four aphid vectors in the ecology of SN and SM virus isolates. Aphid transmissibility of SN and SM isolates supports their identification as potyviruses.

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RICHARDS FUNCTION—A FUNCTIONAL GROWTH ANALYSIS MODEL FOR RICE CULTIVARS (*ORYZA SATIVA* L.)

P. S. SRINIVASAN, K. MOHAN NAIDU and C. R. RANGANATHAN
Department of Crop Physiology, Tamil Nadu Agricultural University, Coimbatore 641 003, India.

THE classical form of growth analysis has been combined by a second approach called functional growth analysis[1]. This has arisen partially from the limitations of classical growth analysis based on the assumptions made in the growth analysis. Radford[2] proposed the functional or dynamic approach in growth analysis especially for more frequent and smaller harvests (1 to 3 days) when the grouping of plants can be avoided. The data then used to describe accurately the relationships between weight and time which are usually fitted with approrpriate polynomial functions. The major advantage of this approach is that information for the whole period of interest is contained in two equations.

A critical summary of the development and use of functional growth analysis is given by Vernon and Alison[3] and Hunt[4].

The study was conducted during 1982 at the paddy experimental fields of Tamil Nadu Agricultural University, Coimbatore to ascertain the possible effects of zinc (Zn) on the total dry matter produced in rice cultivars. Three cultivars of rice namely, Jaya, IR 20 and Kanchi were chosen based on their relative susceptibility to Zn. The duration of the cultivars was Jaya (130–135), IR 20 (125–135) and Kanchi (110–115) days. Three levels of Zn (12.5, 25 and 50 kg $ZnSO_4$/ha) were adopted for the experiment. The data on total dry matter production was considered for fitting the Richards function[5] to explain the whole growth in terms of total dry matter produced.

The Richards equation is given by

$$W = A[1 + \exp(\beta - kt)]^{-1/n}$$

where W = total dry matter production during time t, A, β, k and n are constants and t = time interval.

The total dry matter produced at different stages with particular reference to $ZnSO_4$ 25 kg/ha in all the three cultivars were taken into account for calculating the constants A, β, k and n of the model by following the empirical procedure suggested by Richards[5]. The utility of this function has been advocated by Venus and Causton[6] for the whole plant growth analysis.

In the above equation the sign is positive if n is positive and vice versa. From the fitted equation, the mean relative growth rate ($\bar{R}$) was calculated using the following formula as suggested by Causton and Venus[7].

$$\bar{R} = \frac{k}{n+1}$$

where $\bar{R}$ = mean relative growth rate.

To express the trend of growth in terms of total dry matter production from transplanting to harvest, the Richards function was fitted by considering the values in all the three cultivars at medium supply of Zn (25 kg/ha). It was observed from the fitted equation (figure 1), that in the cultivar Jaya, the increase in total dry matter was possible upto 45 g/hill. In IR 20 and Kanchi, the value could go upto 50 g/hill. The mean relative growth rate calculated from the fitted equation denoted that in IR 20, the mean relative growth rate for the whole duration was 27.90 mg/g/day, while in Jaya 24.70 mg/g/day and in Kanchi it was 20.70 mg/g/day. It appeared that IR 20 exhibited a higher mean relative growth rate for whole duration of the crop.

To compare the two sets of data in the functional growth analysis, Venus and Causton[6] introduced the Richards function. From the fitted equation it is clear that the total dry matter production in each cultivar exhibited a definite pattern of growth. In Jaya, the total dry matter production could be increased upto 45 g/hill, whereas in IR 20 and Kanchi, the increase could go upto 50 g/hill. The derived mean relative growth rate also indicated the capacity of IR 20 to register a high mean relative growth rate of 27.90 mg/g/day, as compared to the other two cultivars. The Richards function thus has considerable flexibility and Venus

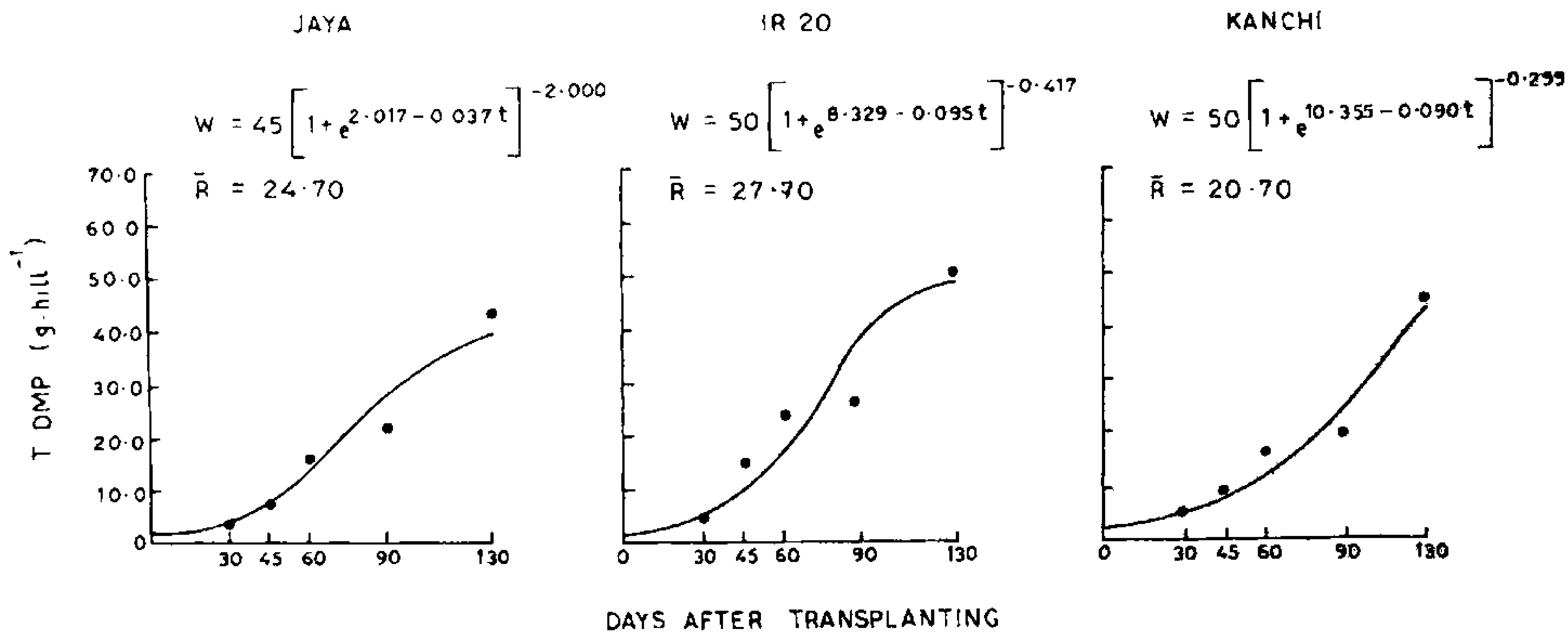

Figure 1. The Richards function curve for total dry matter production.

and Causton[6] contend that it provides a more biologically meaningful fit than a polynomial equation when fitted to data collected over several days.

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COMPARATIVE STUDY ON THE PHOTOSYNTHESIS AND PRODUCTIVITY OF TRITICALE, RYE AND WHEAT

D. C. UPRETY, M. C. GHILDIYAL and G. S. SIROHI
Division of Plant Physiology,
Indian Agricultural Research Institute,
New Delhi 110 012, India.

TRITICALE is established as a cereal crop in many countries. It appears to combine some of the yield and grain characteristics of its wheat parentage, with some of the hardiness of its rye parentage[1]. The potential productivity of the new cereal 'Triticale' is difficult to assess as it depends on the meiotic stability and seed fertility as well[2]. The comparison between the photosynthesis of leaves of triticales and that of cultivated *Triticum* and rye can provide information on the productive capacity of this new cereal. The experiment reported here was undertaken to compare the octoploid *Triticale* with *Aestivum* wheat and rye for their photosynthetic efficiency, leaf area development, stomatal resistance, chlorophyll content and biomass production.

Triticale PMT-5 (8x), Sonalika (*Triticum aestivum*) and Russian rye were raised in rectangular (30 × 20 cm) cement pots kept under natural conditions during the crop season 1984–85. Each pot with 6 plants were adequately fertilized for maintaining optimum growth. Sonalika and Russian rye were selected for comparison because they are being commonly used for Triticale breeding programme in India. Observations were taken at three stages *i.e.* preflowering, flowering and postflowering. Post-flowering observations were taken 15 days after flowering.

Photosynthesis in the flag leaf of mothershoot was measured by a portable infrared gas analyser (ADC) in the natural light conditions. Net photosynthesis was calculated from CO_2 exchange measurement made in the single leaf chamber[3]. LiCor Li 1600 diffusion promoter was used for measuring stomatal resistance in intact flag leaf in the forenoon under full sunlight. Chlorophyll was extracted by a nonmacerated method using dimethyl sulphoxide[4]. Chlorophyll A, chlorophyll B and total chlorophyll were determined on fresh weight basis. Leaf area development was studied using a leaf area meter (LiCor 3100). Growth data such as leaf number, dry weight of leaves, stem and ear were measured at all the three stages. The grain yield and harvest index were determined at harvest. All these data were taken on per plant basis. Data were analysed statistically following the method of analysis of variance.[5] The net photosynthesis in the flag leaf of triticale was significantly higher than that of wheat and rye at preflowering and flowering stages. At post-flowering stage, however, rye had more photosynthesis rate than the other two species. This was because rye maintained more or less similar photosynthesis rate at flowering and post-flowering stages. On the other hand photosynthesis rate was reduced at post-flowering in both triticale and wheat. The triticale and rye had significantly lower stomatal resistance than wheat in all the stages. Stomatal resistance of leaf was lowest at the flowering stage and highest at the post-flowering stage in all the species. The chlorophyll content (total) was higher in rye both at preflowering and flowering stages than wheat and triticale and it was due to higher chlorophyll A content. Though the total chlorophyll content in rye was not similarly high at post-flowering stage, chlorophyll A remained higher throughout the stages studied (table 1).

The number and the area of leaves per plant were higher in Russian rye at flowering and post flowering stages. The total photosynthetic surface including the leaf number was smaller in triticale as compared to wheat and rye. At the initial stage the dry weight of wheat leaves and stem was higher, however, at the post-flowering stage the dry matter production was significantly higher in triticale. In the case of rye the largest accumulation of dry matter was observed in stem and partitioning to ear was comparatively very poor *i.e.*,