'J.D. Dwarf': a superior Cavendish cultivar?

J. Daniells

Bananas and plantain represent the number one fruit crop in the world, both in terms of production, around 98 millions tonnes, and trade, valued at over US$4306 million (FAOSTAT database 2002). Cultivars belonging to the Cavendish subgroup (AAA) account for 41% of world production, of which one-third (or 13% of world production) is exported (INIBAP 1999).

The Cavendish cultivars have dominated the export trade since the demise of 'Gros Michel' over 50 years ago thanks to their high yields, long transport life and widely accepted flavour. Their main drawback is their susceptibility to a wide range of pests and diseases, in particular black leaf streak disease(*Mycosphaerella fijiensis*). As a result, they require regular applications of pesticides. Efforts by research organizations have been underway for several years to find a replacement that would have equivalent features as the Cavendish cultivars but would be less dependent on pesticides.

Several Cavendish cultivars, like 'Grande naine', 'Williams', 'Valery', 'Poyo', 'Robusta' and 'Giant Cavendish', are grown all over the world, each having its own advantages and disadvantages. For example, the 'Grande naine' cultivar tends to be less prone to wind damage but does not fare as well as taller cultivars, such as 'Robusta' and 'Valery', in poorer soils and drier conditions. The main cultivar grown in Australia is 'Williams', which occupies over 10 000 hectares.

In 1988, the Queensland Department of Primary Industries (QDPI) came up with a variety, 'J.D. Dwarf', which may be of interest to smallholders around the world. 'J.D. Dwarf' was collected as an offtype in 1988 in a tissue culture planting of the 'Williams' cultivar. Data were collected on a few plants grown at the South Johnstone Research Station and trials were established on growers' properties in 1990. The cultivar was released to the industry in 1998 for more widespread on-farm evaluation (Daniells and Bryde 1998). It is now grown on about 100 ha in northern Queensland.

Research station observations

The original selection was very dwarf in habit and had unusually upright leaves but in subsequent plantings, the dwarf habit was much less pronounced. Compared to 'Williams', 'J.D. Dwarf' is not dramatically different in height. As shown by our limited trial results, 'J.D. Dwarf' tends to be marginally taller in mother plant crops and slightly shorter in ratoon crops (Table 1).

The fruit of 'J.D. Dwarf' tends to be about 5% shorter than 'Williams'. This could impede the adoption of 'J.D. Dwarf' by wholesalers and retailers who tend to pay premium prices for longer fruits, even if consumer surveys indicate a preference for fruits of intermediate length. This difference in length would be of lesser consequence for smallholders producing for home consumption and domestic sales.

When harvested at the same finger diameter, bunches of 'J.D. Dwarf' weighed less than 'Williams', although the difference was not significant. However, 'J.D. Dwarf' bunches can be allowed to fill out more so an extra week of fruit filling can make up for the otherwise reduced bunch weight.

On-farm observations

'J.D. Dwarf' has a sturdier pseudostem than 'Williams' (Figure 1), a feature which makes it more resistant to wind damage, the single most important cause of yield loss in banana plantations (Stover and Simmonds 1987). The greater wind resistance of 'J.D. Dwarf' should reduce some of these losses. This should translate into economic benefits for commercial growers and enhanced food security for subsistence farmers. 'J.D. Dwarf' can also often be grown without any form of bunch support such as twine or wooden/bamboo props. Another contributing factor to its stability is its relatively upright pseudostem which seldom leans. However, special care needs to be taken during harvest. When the pseudostem of 'J.D. Dwarf' is cut with a cane knife or machete, the pseudostem can collapse as the bunch is lowered onto the shoulders of the person harvesting.

Maturity staining is a physiological disorder of the fruit which is characterized by bronze-red blemishes on the peel. It causes major production losses in northern Queensland (Daniells 1985) and in some places like Costa Rica (Lahav *et al.* 2000). Growers' observations indicate that 'J.D. Dwarf' is less prone to maturity staining. The fruit of 'J.D. Dwarf' can be allowed to fill out more with much less maturity staining compared to 'Williams'.

During the cooler winter months of northern Queensland, fruit chilling in the field is a significant problem (Daniells 1997). The same is true of other marginal production areas located away from the equator. Fruits of 'J.D. Dwarf' tend to be less sensitive to chilling than 'Williams'. Consequently, it has a good bloom and a nice yellow colour during ripening, provided temperatures do not plunge too low. The growers in our trials consistently received better prices for 'J.D. Dwarf' because of its better 'bloom'.

The upright leaves of 'J.D. Dwarf' (Figure 1) may explain the better fruit bloom and lesser maturity staining because of the resulting better light regime in the canopy. 'J.D. Dwarf' may have a higher optimum plant density, but this requires investigation.

Table 1. Yield and plant characteristics of J.D. Dwarf at South Johnstone Research Station and cooperating growers' properties.

	Days from planting to bunch harvest	Bunch weight (kg)	Finger length of second hand (cm)	Pseudostem height (cm)	Leaf lamina length (cm)	Leaf lamina width (cm)	Length to width ratio of leaf lamina
South Johnstone Research Station[a]							
J.D. Dwarf	351 ± 4 [b]	22.9 ± 1.4	24.5 ± 0.5	214 ± 4	195 ± 6	89 ± 1.9	2.20 ± 0.03
Williams	363 ± 5	24.9 ± 0.7	25.9 ± 0.5	205 ±4	195 ± 3	84 ±1.3	2.34 ± 0.02
Ratoon #2 [c]							
J.D. Dwarf	908 ±10	40.0 ± 2.1	25.6 ± 0.5	303 ±7	252 ± 7	101 ±1.7	2.49 ± 0.04
Williams	952 ± 21	44.0 ± 2.0	27.1 ± 0.5	327 ± 20	265 ± 13	98 ± 2.9	2.69 ± 0.08
Growers' properties [d]							
J.D. Dwarf	400	26.1	24.0	237	n.a.	n.a.	n.a.
Williams	403	27.3	24.8	232	n.a.	n.a.	n.a.

[a] Data are the means of six plants.
[b] Standard error of the mean.
[c] Data for first ratoon have been excluded because of wrong sucker selection.
[d] Data are the means of four locations with 20 plants per variety at each location; only data on plant crop are available from growers.

Some growers have found that 'J.D. Dwarf' is easier to pack in the existing 13 kg fibreboard cartons. This is because the fruit of 'J.D. Dwarf' fills out right to the tip - there is no pinching on the flower end. Thus there is more weight for a given length of fruit, and even more so if bunches are allowed to fill out. J.D. Dwarf also has well shaped hands, which further facilitates packing.

In northern Queensland, emerging bunches, when still upright, are routinely injected with insecticide for the control of the banana scab moth *(Nacoleia octasema)*, and incidentally for the control of flower thrips (*Thrips hawaiiensis*). But because the leaves of 'J.D. Dwarf' are so upright, it is more difficult to detect and easily inject the emerging bunch. Ground application of fungicides can also be hampered by its upright leaf habit.

Bacterial corm rot caused by *Erwinia* spp. is a growing problem in northern Queensland (Daniells 1995). Losses from plant fallouts have been as great as 20-30% in some first ratoon crops. Indications so far from growers are that 'J.D. Dwarf' is more susceptible than 'Williams' to corm and heart rots. 'J.D. Dwarf' may be more sensitive to environmental stresses making it more vulnerable to invasion by this opportunistic pathogen (Buddenhagen 1994). Ongoing studies may identify antagonistic microorganisms to inoculate tissue culture plantlets.

So far, field plantings of 'J.D. Dwarf' established from tissue culture have been reasonably true-to-type, with less than 3% offtypes on average. Interestingly, most of these offtypes are a throw back to 'Williams' from which the cultivar is derived. If other clones produced as few offtypes as 'J.D. Dwarf', growers would be more appreciative of tissue culture.

Conclusion

The origins of 'J.D. Dwarf' highlight the value of collecting and conserving germplasm variants of tissue culture plantings. It also highlights the need for the scientific community and growers to be on the lookout for any variation which might have potential benefits (Daniells and Smith 1993). Now, more than ever, banana growers need to exploit variations for the benefits they may bring.

As to whether 'J.D. Dwarf' is a superior Cavendish cultivar, the answer will depend on local circumstances. Daniells (2000) has argued that there is no perfect variety, that each has its own set of advantages and disadvantages. Growers must find out what is best for them. Those wishing to evaluate 'J.D. Dwarf' should contact INIBAP. ■

***Figure 1.** 'J.D. Dwarf' (right) has more upright and slightly wider leaves than 'Williams' (left).*

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Jeff Daniells works at the Queensland Department of Primary Industries. PO Box 20, South Johnstone, Qld 4859, Australia.