

WALNUT HYBRIDS IN THE UK

FASTGROWING QUALITY HARDWOODS

Jo Clark and **Gabriel Hemery** report on field trials established in 2003 to test five walnut hybrid varieties. Planted within an innovative silvicultural mixture, five years on, some have shown outstanding growth.

European tree breeders, particularly in France, have developed several varieties of walnut hybrids and made these commercially available. They include both *Juglans nigra* x *J. regia* (e.g. NG23, NG38) and *J. major* x *J. regia* (e.g. MJ209) crosses, all of which are vigorous and have good form. Hybrids planted into existing woodlands in continental Europe have grown very well, generally have good apical dominance and fewer branches per annual whorl than either species. Annual pruning is essential to prevent main side branches becoming more than 2cm in thickness in the first growing season. If done correctly, pruning wounds heal over well and rapidly.

Trials by the Institut pour le Développement Forestier (IDF) in France, all on ex-farmland, indicated phenomenal growth where after 8 years, mean height was 7.5m (6.2 - 9.1m) and dbh 41.3cm (28-50cm). Hybrid walnuts seem to exhibit the best characteristics from parent species and are more tolerant of marginal sites (Becquey, 1997). The oldest hybrid trials indicate that timber produced is of good quality.

There have been limited plantings of walnut hybrids in the UK. Some planting, mostly within silvicultural trials, was undertaken by the Northmoor Trust in the early 2000s. There were however, no varietal tests of any walnut hybrids. Given the interest from landowners in fast growing quality hardwoods, a field trial was established in 2003 by the Northmoor Trust to test some common and less well

known walnut hybrid varieties in the UK. This article presents the data and analyses of the field trial five years after establishment.

Method

Hybrid Selection

Five walnut hybrids were selected for inclusion in the field trial (Table 1). The French hybrids *Juglans* x *intermedia* NG23 and MJ209 were purchased from the Walnut Tree Company Ltd. as bare root 60-90cm plants. The other French hybrid NG38, also purchased from the Walnut Tree Company Ltd., had remained in the nursery a year longer than usual and put on excellent extension growth, but had not been undercut. Therefore, these were one year older at planting than the other French hybrids and had very poor roots as these were damaged during transplanting.

Two other hybrids were tested in this trial.

Bressanvido is a naturally occurring hybrid from Italy, found in the Italian province Vicenza, (45 34' lat, 11 31' long) at 35m asl, where the alluvial soils are a sandy clay loam. The maternal parent is *Juglans nigra*, and the paternal parent is thought to be *J. regia*, although the exact parental identity is being determined by the Istituto Sperimentale Per La Selvicoltura who kindly donated the trees. It was noted at time of planting that several of these had very poor roots, which had possibly died during transport.

The other hybrid tested was the clone IRTA X-80 that was



Hybrid walnut MJ209 at year 6, after thinning of the alder nurse.

Table 1. Details of the hybrids used in the trial.

Hybrid	Maternal parent	Paternal parent	Origin	Notable features
NG23	nigra	regia	France	Excellent vigour and form.
NG38	nigra	regia	France	Vigorous growth, less susceptible to anthracnose.
MJ209	major	regia	France	Vigorous growth, less susceptible to anthracnose.
Bressanvido	nigra	regia	Italy	Naturally occurring hybrid.
IRTA X-80	nigra	regia	Spain	Good form, low fruit production.

that five walnuts (all Bressanvido) were probably dead at planting time.

Walnuts were planted at approximately 8 x 8m triangular spacing within a matrix of trees planted at 1.75 x 2.00m (Figure 1) including Italian alder (*Alnus cordata*), silver

multiplied in-vitro by Vitrotech (<http://www.vitrotech.es>) in Spain and purchased from Biotecnologia Vegetal. It is a *J. nigra* x *J. regia* cross, bred from selected material exhibiting outstanding form. The clones received were very young and averaged only 10cm tall at planting time.

Field trial establishment

The field trial was established in Paradise Wood experimental woodland in South Oxfordshire in the winter of 2003. The site is level and well drained with neutral pH sandy-clay loam, at altitude 55m asl. The experiment was laid out as a randomised complete block design of four blocks, each containing single line plots of six trees, for each of five walnut hybrid varieties, i.e. 24 trees per hybrid. All trees were planted as per the trial design (Figure 1), although it was noted

birch (*Betula pendula*) and wild cherry (*Prunus avium*). This enabled grant support as the stocking density qualified for the Forestry Commission Woodland Grant Scheme.

The species mixture was adapted from a design developed by Clark *et al.* (2008) for common walnut (*Juglans regia*), although this included various shrub species omitted in this trial. It was designed to provide optimal architectural compatibility and nitrogen-fixing ability from the alder, rapid establishment and shelter from the birch, and a compatible and highly valuable companion timber species with the cherry.

Assessment and Analysis

Walnut tree height was measured to the highest live bud at planting time and thereafter at the end of each growing season.

Data were analysed using Genstat 11th Edition, based on plot means. Due to the variation in tree height at time of planting, planting height was used as a covariate. However, this was found to be non-significant, and therefore the model of the variance of analysis used was: replicate + hybrid. Least significant differences were calculated at the 5% level.

Results

Survival

Survival was highly variable between hybrids (Table 2). Survival remained the same after five years, as at year 1, with the exception of the

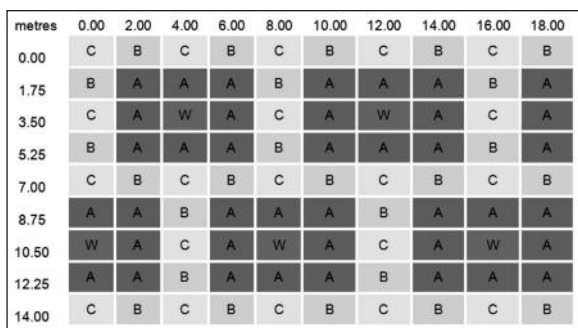


Figure 1. Planting pattern showing walnut (W) at 8 x 8m triangular spacing surrounded by alder (A) within a matrix of birch (B) as a nurse and with cherry (C) at wide spacing.

micro-propagated IRTA X-80, which decreased from 96% survival to 29%. Survival was so poor for this hybrid (in most reps only one tree survived) that it was dropped from the analysis of tree growth.

Height growth

Walnut height growth was poor during the first four years, with the exception of NG38 which appeared to establish well, even after one year. Height growth of NG38 was particularly poor, growing only 31cm (8%) in four years.

During the fifth growing season however, walnut hybrid growth was greater and in some cases, phenomenal. Analysis of variance for tree height increment revealed highly significant ($p = 0.025$) variation between hybrids. Least significant means (91.7cm at 5% level) indicated that statistically, the Bressanvido trees grew significantly less than the other three hybrids, while NG38 trees grew significantly more than the NG23 and Bressanvido trees. Mean height increment was 135cm for NG38 during 2008, and 253cm across the five growing seasons (Table 3). There were no significant differences for growth between MJ209 and the other hybrids.

Tree height after five years was highly significant ($p = 0.032$) between the hybrid treatments. NG38 trees exceeded three metres (3.18m) in height at the end of 2008, NG23 2.9m and MJ209 1.54m (Table 3). Least significant means (96.4cm at 5% level) revealed that NG38 trees were significantly taller than the

Table 2. Survival of walnut hybrids, at 1 and 5 years after planting. Twenty four trees of each hybrid were planted in 2003.

Hybrid	Survival 2004		Survival 2008	
	Year 1		Year 5	
	% (number)		% (number)	
NG23	100	(24)	100	(24)
NG38	100	(24)	100	(24)
MJ209	96	(23)	96	(23)
Bressanvido	54	(13)	54	(13)
IRTA X-80	96	(23)	29	(7)

Bressanvido trees, but not MJ209 and NG23. Also, Bressanvido trees were significantly shorter than all other hybrids.

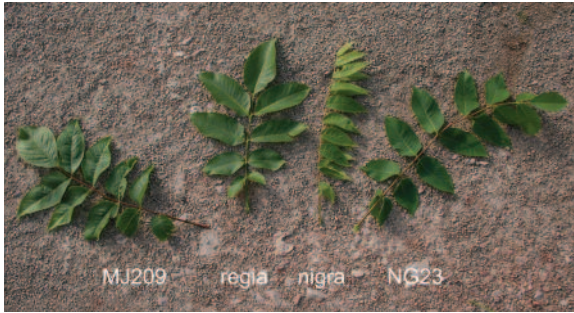
Conclusions

Four years after planting, this trial was disappointing in terms of walnut vigour. However, after the fifth growing season, startling differences were observed, especially in the growth of the French hybrids. It is well known that walnut does not transplant well and this is apparent in this trial. The hybrids NG23 and Bressanvido had particularly poor root systems, and the IRTA X-80 clones were extremely small. It can therefore be postulated that in the first four years of growth, the walnuts were investing in root, rather than shoot, growth. Once the root to shoot ratio had come into balance, the walnuts put on top growth, as indicated by the fifth year increment results. NG38 and MJ209 were the

Table 3. Mean walnut height (cm) of hybrids from time of planting (2003) until year 5 (2008) and mean height increment over 5 years.

All data are based on plot means. Data for hybrid IRTA X-80 are included for completeness only and are based on too small a sample to be statistically robust.

Hybrid	Mean end of year tree height (cm)						Mean height increment (cm)		
	2003	2004	2005	2006	2007	2008	0-4 yr	0-5 yr	4-5 yr
NG23	169	174	178	192	200	290	31	121	90
NG38	65	84	113	155	183	318	118	253	135
MJ209	83	93	105	128	146	257	63	178	111
Bressanvido	62	63	72	88	95	154	44	90	59
IRTA X-80	10	13	14	26	26	38	16	28	12



Leaves of walnut species and hybrids.

most robust at time of planting, and grew moderately in height each year. Growth increased substantially once that the trees were established. Indeed, one NG38 individual grew 2.68m in the fifth growing season.

It is unfortunate that survival was so poor in the micro propagated clone IRTA X-80. The clones were healthy on delivery from the laboratory. However, average height at planting was only 10cm and this was not expected. The trees were nevertheless planted in the trial rather than being potted up for one to two years first, so that planting year was the same for all hybrids. It would not be recommended to plant such small trees in the field under normal circumstances.

The naturally occurring hybrid Bressanvido performed moderately and mortality was due to the condition of the plants upon delivery. Again, once established, this hybrid performed well and appears suitable for growing in the UK.

The wild cherry, although not measured in this experiment, established and grew well making this a useful companion species. The Italian alder established rapidly and grew to such an extent that the four trees closest to the walnut and cherry had to be removed in year six due to over topping. Whilst foliar nitrogen levels in the walnut were not assessed, it is likely that some fertilising effect is achieved though the alder. The field trials will continue to be monitored to provide longer term data on the silvicultural system, and to provide growth and yield models for walnut hybrids under British conditions.

In relation to markets for hybrid walnut and its place in British forestry, the relatively fast growth of this hardwood producing tree may prove to be a valuable component in some new

plantation woodlands, particularly short rotation forestry systems. The market for such fast grown timber is clearly not destined for structural use where strength is required but would certainly satisfy functional product manufacturing, for example relatively cheap furniture. The wood from hybrid walnuts lacks the dark and often beautiful figure common in its parents, particularly *Juglans regia*, but it is commonly sliced for veneer in France and Italy. The resulting pale and plain figured veneer is usually steamed to darken its appearance, and it is widely used in furniture making in some countries on the European continent. Finally, with increasing interest in wood heat and energy, it would be interesting to consider the calorific value of walnut hybrids and their potential to provide bioenergy as a by-product to their timber output.

Acknowledgements

Woodland Heritage for a grant in support for the purchase of the trees. Northmoor Trust for hosting the field trial. Walnut Tree Company for sourcing the French material. Dr Fulvio Ducci of Istituto Sperimentale Per La Selvicoltura, Italy for sourcing the Italian material.

References

- Becquey, J. (1997) *Les noyers à bois*. 3rd edn. Institut pour le développement forestier, Paris. 143 pp.
- Clark, J., Hemery, G. and Savill, P. (2008) Early growth and form of common walnut (*Juglans regia* L.) in mixture with tree and shrub nurse species in southern England. *Forestry*. **81**, 5, 631-644. 10.1093/forestry/cpn036

Jo Clark is Forestry Research Manager for the Northmoor Trust (www.NorthmoorTrust.co.uk), currently working on a doctorate investigating the adaptation of ash to climate change.

Gabriel Hemery is Chief Executive of the Sylva Foundation (www.Sylva.org.uk), and Director of the think-tank Forestry Horizons (www.ForestryHorizons.eu).