Experiences with Growing Common Walnut

Jo Clark reports on the results on a walnut stumping experiment.

Walnut (*Juglans regia* L.) is an attractive species to grow for landowners. When grown on the right site, it can produce a final crop on a 50 year rotation, and can be more valuable than veneer oak.

However, it has the reputation of being tricky to get right, and to produce valuable straight stems. Earth Trust and Future Trees Trust have established several walnut trials over the years in partnership with the National Forest and Forest Enterprise. These include a silvicultural trial at Jaguar Lount Wood in Leicestershire that investigates the effects of various tree and shrub nurse combinations on the growth of common, black and hybrid walnuts, as well as several progeny and provenance trials for common and black walnut planted between 1998 and 2005 (Clark et al., 2005; Hemery et al., 2005). Several of the walnuts in the silviculture trial at Lount Wood, particularly the black walnut, were of very poor form, and treatments were carried out (in summer and winter) to investigate the effects of stumping on the growth response of eight year old walnut (Clark and Brocklehurst, 2011). The results were so favourable – most walnuts stumped in winter caught up with non-stumped walnuts within two years – that it was decided to carry out this treatment on a common walnut trial that was suffering from severe dieback in Paradise Wood on the Earth Trust's estate in south Oxfordshire.

Figure 1. Pruning to a single leader at the Oxfordshire site. July 2004.

Background

In 1998 combined progeny and provenance trials for common walnut were planted at three sites in lowland England (Hemery, 2000). These are at Northwick Estate in Gloucestershire, Maunsel Estate in Somerset, and the Earth Trust Estate in Oxfordshire. They form a genetically diverse collection from the natural and introduced ranges of common walnut, comprising 365 progenies, of 25 provenances from seven countries: Spain, Tajikistan, Kyrgyzstan, Iran, Romania, Slovakia and Turkey. Trees were planted at 5 x 5m spacing in blocks of 100 trees. There are 14 blocks at the Oxfordshire site and four blocks at both the Gloucestershire and Somerset sites, a total of 2,200 trees. All provenances are replicated at every site, but not all progenies due to insufficient numbers of some of them.

Although all trees originally established well, it was evident from early on that the form was extremely poor, with severe dieback occurring every year. Although silvicultural interventions are not usually carried out on genetics trials, during the summer of 2004 all trees at the site in Oxfordshire were pruned to a single leader in an attempt to correct form (Figure 1). The Oxfordshire site was assessed in most years from early establishment, and all three trials were assessed for height, diameter and form at year 5 and 10 (2003 and 2008). Timing of budburst was assessed in year 10. Two reports were written on 1) performance and 2) form relating to timing of budburst by undergraduates from the University

of Oxford. Spring frost damage is uncommon, as walnut is usually the last tree to come into leaf, and the poor form is attributed to insufficient hardening off in the autumn. The form of all trees was so poor by year 10 (2008) that the analysis of the family data was of little value, with environmental effects overriding genetic differences (Figure 2).

Table 1 shows mean height, survival and growth increment for the trial at Little Wittenham until 2008, the time of the last full assessment. It demonstrates that year by year, survival decreased gradually, as did growth increment. The slight increase in increment in 2004 can be attributed to the extensive formative pruning carried out that summer, with the trees sending resources to the singled leader.

Methods and materials

Based on the work carried out in the silvicultural trial for walnut in the National Forest, Leicestershire, it was decided to stump the trial in Oxfordshire. The trial hosts in Gloucestershire and Somerset declined to stump their trees, although form was also poor at these sites. Prior to stumping, a nitrogen fixing shrub, autumn olive (*Elaeagnus umbellata*), had been planted in between the walnuts within row (i.e. also at 5 x 5m spacing) and also in between the rows of walnut, but at double the density, at 2.5m spacing. Thus, each walnut was surrounded by eight *Elaeagnus*, which were planted in 2007 as 20-40cm one year old plants. Some areas of *Elaeagnus* failed due to waterlogging, and were beaten up in 2008, but there remain a few areas within the trial where the *Elaeagnus* failed. Establishment of the *Elaeagnus* took several years, and it was necessary to ensure good nurse cover, prior to stumping.

In February 2012 one of the 14 blocks was stumped at the Oxfordshire site as a test to determine whether the results would be as dramatic as in the National Forest, where

Table 1. Mean survival and growth of walnut at the Oxfordshire site 1998 -2014.

Year	Survival (%)	Height (cm)	Inc./yr (cm)
1998	100	11.1	
1999	98.4	42.4	31.3
2001	98.1	97.8	27.7
2002	98.1	118.1	20.3
2003	98.0	129.6	11.5
2004	97.7	150.0	20.4
2008	93.0	180.0	7.5
2014†	85.6	102.0	102.0

†Stumped January 2014, assessed December 2014 – one year's growth.

Figure 2. A 13 year old walnut with poor growth and form. March 2012.

walnuts had been established with nurse species at time of planting. The walnuts responded well (by visual observation only) so in January 2014, the remaining 1300 trees were stumped at approximately 10cm above ground level using a chainsaw. The stump diameter was measured to the nearest millimetre and the stumps protected with 60cm meshguard, kindly donated by Tubex, and put in place using volunteers. Coppice regrowth after stumping tends to occur at two heights – a few taller shoots (termed 'dominant' in this context) and a greater number of more variable shorter shoots (termed 'lesser'). A dominant shoot is classified as equally competing with the leaders. In January 2015 all trees were assessed for regrowth, with the number of dominant and lesser shoots counted, and the height of the dominant shoot recorded. Trees were also assessed for how successful stumping had appeared after one year. A purely subjective score was given on a visual basis as 1-5.

1 = Failed to resprout, or regrowth almost dead
2 = Poor
3 = Acceptable
4 = Good
5 = Excellent

These are obviously arbitrary classes but easily assigned especially once several stems have been viewed and were given as a means of quantifying the success of the treatment.

Results and discussion

Survival

Prior to any intervention 99 out of 1400 of the walnuts were recorded as dead in 2011. Of these 99, 22 had resprouted in 2014. Of the live trees that were stumped, 125 failed to resprout, and 60 resprouted, but then died (swamped by grass or presumed lack of light in a few cases, or had bark stripped by deer). Therefore, the *Elaeagnus* were cut back sufficiently hard to ensure a clear growth area for the walnuts in spring 2015, prior to walnut budburst.

Stump diameter

Mean stump diameter of all walnuts was 70.3mm (±27.8 SD; range 20-160mm). Mean stump diameter for those that failed to sprout was 61.5mm (±23.7 SD; range 20-151mm). While those trees that died had a slightly smaller than average stump diameter, this was unlikely to be a contributing factor to mortality as other trees with small stumps grew very well.

Figure 3. A 15 year old walnut stumped in January 2014, with two years regrowth. Photo taken April 2016.

In the vast majority of cases it was possible to attribute mortality to dense shade or rank grass smothering regrowth.

Number of shoots

The mean number of dominant shoots was 1.8, with 27 trees having more than 5, and the mean number of lesser shoots was 4, with 57 trees have more than 10 lesser shoots.

During the first growing season after stumping many walnuts grew extremely well, often catching up with their pre-stumped height. While the regrowth was extremely impressive, it was almost too impressive in some cases, such that the stem was unable to support the weight of all the leaves, and many of the most successful stems bent over and partially snapped. Fortunately, there were several stems to choose from, and when the trees were singled in February and March 2016, it was possible to select the best undamaged stems, and at the same time, cut back side branches to prevent the same happening again in 2016 (Figure 3). Also, several trees were staked at this time.

Conclusions

This was a large undertaking, carried out over several years with the aim of improving the growth and form of the walnuts to enable assessment of the genetic worth of the trees longer term. An average of 1.8 dominant shoots per stumped tree is a good result. While a single leader might be viewed as ideal as requiring no singling subsequently, in reality, many leaders were bushy, and bent over due to weight of the leaves. Where there were two or more, it enabled a second winner to be chosen the following year. The more vigorous of the lesser shoots have been removed, and many of the smallest ones left to provide some photosynthetic capability, while having minimal impact on form. It is expected that these minor shoots will become insignificant, and can be removed if desired, but will likely self-prune with time.

The first conclusion that must be drawn is that Paradise Wood is not a good site for growing walnut for timber. An

Table 2. The percentage of walnut trees at the Oxfordshire site that fell into each regrowth category, two years after stumping.

Form Score	Percentage (%)
1 – dead	11.5
2 – poor	15.9
3 – acceptable	18.9
4 – good	23.7
5 – excellent	30.0

initial assessment of the site might lead one to suppose, however, that walnut will grow well here. The site has good brown earth soils, and, according to Ecological Site Classification, is suitable in terms of temperature and rainfall. However, the site is located at the base of the Wittenham Clumps, the only high landmark around in the floodplain of the river Thames, and so sits in a frost pocket with resultant spring and autumn frost damage to leaves and stems. At the time of planting, in 1998, the site was very exposed with very little shelter and this undoubtedly had a large detrimental effect on walnut performance. Additionally, research carried out by Clark et al. (2008) on a walnut silviculture trial with various tree and shrub nurses, planted adjacent to the walnuts reported here, found that plots were deficient in nitrogen other than those with nitrogen fixing nurse species, a phenomenon not uncommon in ex-arable sites such as this, accustomed to an annual input of fertilizer.

The second conclusion we can draw is that although 15 years of age is late to be stumping, (because of the loss of 15 years growth) in this instance, the work has been well worth undertaking as it is now possible to see how this research trial can yield results in the future, and also realise some valuable timber. 72.6% of the trees now fall in to the top three categories of acceptable to excellent, whereas prior to this work, it would have been impossible to find more than a handful of straight stems.

So, should one try and grow walnut for timber? I would say definitely yes, as long as the site is carefully selected in the first instance, shelter is provided, and that you are willing to prune your trees regularly, particularly during the first 10-15 years of growth. When these factors are accounted for, results can be highly satisfactory.

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