



**Forestry Research Report 2013**  
**Walnut Trials at Lount Wood, National Forest**



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# Walnut Silviculture Trial at Lount Wood

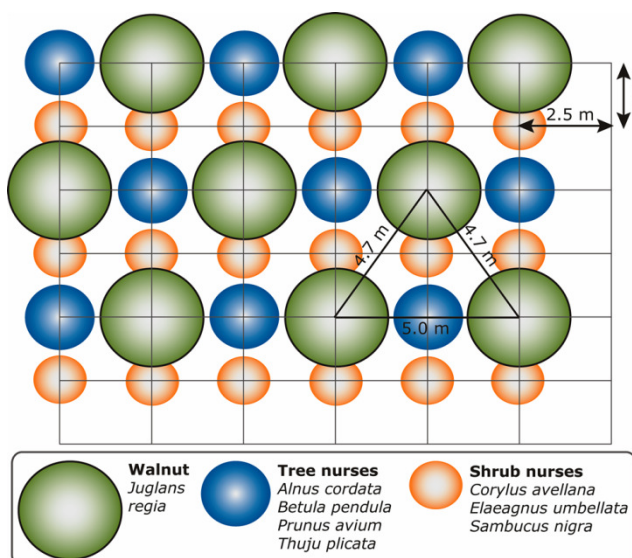
Report submitted by the Earth Trust in accordance with the Annual Management Agreement 2013/14.

## Introduction

The walnut silviculture trial at Lount Wood in Leicestershire was planted in 2002 to a) test the growth of different species and hybrids of walnut and b) assess various nurse mixtures to promote walnut growth.

The trial comprises two walnut species (*Juglans regia* and *J. nigra*) and two hybrids (NG23 and MJ209) planted in a randomised block design with two blocks. Each walnut is tested with seventeen different tree and shrub nurse combinations, totalling 68 different treatments (Appendix 1). Each treatment (plot) contains fifteen walnuts, of which the central six are assessed in the research to avoid edge effects. Walnuts are interplanted with a tree nurse with rows of shrub nurse in between (Figure 1).

Tree nurses comprise Italian alder (*Alnus cordata*), silver birch (*Betula pendula*), wild cherry (*Prunus avium*) and western red cedar (*Thuja plicata*). Shrub nurses include hazel (*Corylus avellana*), elder (*Sambucus nigra*) and autumn olive (*Elaeagnus umbellata*). A control of no shrub nurse is included, but there is no control of no tree nurse, so the trial is not fully factorial.



**Figure 1.** Walnut silviculture trial design.

There are four walnut species/hybrids in the trial: common walnut *Juglans regia*, black walnut *J. nigra*, hybrid MJ209 (*major* × *regia*) and hybrid NG23 (*nigra* × *regia*). There are two replicates (blocks) for each walnut type, each with 17 different plot treatments comprising tree and shrub nurse combinations.

Poor form had been observed in many of the walnuts after a growth assessment in 2006. In some cases form was so poor that it was decided that formative pruning would not help, and so a stumping treatment was applied. The trial lends itself well to research of this type as a different stumping treatment could be applied to the two blocks. Therefore a summer stumping treatment was applied to block 1 in July 2007 and a winter treatment to block 2 in November 2007 (Clark 2009). The walnuts responded well to the stumping with winter stumping proving more beneficial than a summer treatment, although more shoots resulted with the winter stumping treatment but were stronger overall (Clark and Brocklehurst 2011). Staff from Forest Enterprise singled these walnuts over the next two years.

This report details:

1. which species performs best at a single site in Leicestershire
2. the effect of the various tree and shrub nurses on walnut growth, and
3. the effect of stumping on height growth, five years after stumping.

In this report, the term walnut ‘species’ refers to both species (*J. regia* and *J. nigra*) and hybrids (NG23 and MJ209) for simplicity.

## Method

A ten year growth assessment was carried out in March 2013 on the central six test walnuts in each plot. Walnut height (to the nearest cm) and diameter at breast height (mm) were assessed regardless of whether the tree had been stumped or not. Although 255 walnuts were stumped across both blocks in 2007, this report only details results from the central six test walnuts, of which 122 had been stumped out of the 816 walnuts assessed (Table 1).

Table 1. Number of test walnuts (central six in each plot) stumped per species by block. Block 1 was stumped in July 2007, and block 2 in November 2007.

	regia	nigra	MJ209	NG23
Block 1	10	25	8	12
Block 2	6	27	19	15

Statistical analyses were carried out in Genstat v 11 and are based on plot means.

## Results and discussion

### Overall walnut growth

Over all blocks and plots, mean walnut height was 391 cm and dbh 52 mm, ten years after planting. The hybrid NG23 was the best performing walnut (mean height 429 cm; dbh 60 mm) and *Juglans nigra* the poorest performer (mean height 330 cm; dbh 40 mm). Both walnut and block were highly significant sources of variation ( $p < 0.001$ ) for walnut height growth, indicating a pronounced site effect.

Overall, walnut growth was greater in block 1 than in block 2 with a 23 % increase in height growth and 15 % increase in diameter growth (Table 2). The increase in growth in block 1 was more significant for the hybrid walnuts (39 % for MJ209 and 31 % for NG23) than for the true species (20 % for *J. regia*). There was almost no difference in height growth between the blocks for *J. nigra*.

Table 2. Ten year mean height (cm) and diameter (mm) growth of the six central test walnuts in two blocks in 2012.

	Block 1		Block 2		Mean height	Mean dbh
	height	dbh	height	dbh		
MJ209	471	64	338	44	412	55
NG23	485	64	369	55	429	60
<i>J. nigra</i>	327	38	332	41	330	40
<i>J. regia</i>	420	53	349	51	385	52
Mean	426	55	347	44	391	52

### Walnut growth with nurse treatments

Table 3 shows ten year mean walnut height of the central six trees that were not stumped by tree and shrub nurse species, and by block. The best (in blue) and the worst (in red) performing walnut in each block are highlighted. For each species of walnut, the ones that performed best had *Elaeagnus* as the shrub nurse, with all combinations of tree nurse with *Elaeagnus* giving good results. The only exception was *J. regia* in block 2, which grew best with larch and hazel nurse. Interestingly, the combination of alder and *Elaeagnus* never resulted in the best walnut growth, as might be expected given that both species are nitrogen fixing.

Table 3. Ten year mean height (cm) of the six central walnuts that were not stumped by tree and shrub nurse species. The best performing walnut for each species in each block is highlighted in blue, and the poorest in red.

		Elaeagnus		elder		hazel		none	
		B1	B2	B1	B2	B1	B2	B1	B2
MJ209	alder	640	397	536	392	404	361	633	397
	birch	636	395	490	238	488	374	467	263
	cherry	556	483	305	351	359	351	321	317
	larch	697	402	336	451	439	401	582	257
	none	*	*	*	*	*	*	381	289
NG23	alder	681	567	513	470	473	480	524	342
	birch	687	475	298	332	442	374	411	451
	cherry	562	474	342	251	461	264	548	289
	larch	730	368	521	243	491	372	660	351
	none	*	*	*	*	*	*	298	301
<i>nigra</i>	alder	406	564	453	252	382	305	394	522
	birch	650	462	388	379	184	409	97	417
	cherry	471	363	205	282	171	225	162	212
	larch	623	384	238	283	211	248	381	251
	none	*	*	*	*	*	*	177	241
<i>regia</i>	alder	531	425	383	393	541	496	410	345
	birch	479	410	381	419	477	258	294	391
	cherry	587	409	247	419	431	287	372	278
	larch	567	235	322	313	525	297	447	344
	none	*	*	*	*	*	*	306	241

The poorest performing walnuts occurred with shrub nurses of either elder or no shrub nurse. As the majority of the elder died during establishment, these two shrub treatments are essentially the same - no shrub nurse. The overriding positive effect is due to the inclusion of *Elaeagnus* shrub nurse which provides shelter to the walnut during the early establishment phase, and also a fertilising effect through nitrogen fixation. However, two results require a little further investigation. The poorest performing *regia* in block 2 was with larch and *Elaeagnus* nurse, and this was not expected. In this plot, the *Elaeagnus* had grown particularly well, and were impacting on the walnuts by providing too dense shade. Remedial action is required to allow greater light to reach these walnuts. The other result to note is the performance of the *nigras* in block 1. These were substantially poorer in performance than any other trees within the trial. Only four of the original six trees were alive, and two of these had suffered severe dieback to about 30 cm although they were growing well (100 cm) in the 2006 assessment. The cause of this is not clear, although it

was apparent that the *nigras* were much the poorest trees in terms of vigour, and indeed, were small at planting time (see National Forest Report for 2006).

#### Walnut growth by stumping treatment

Mean walnut height was 265 cm (dbh 28 mm) for stumped walnuts and 409 cm (dbh 56 mm) for those walnuts not stumped (Table 4). The growth increment was calculated for height growth, but could not be assessed for diameter increment as a measurement of girth was taken in 2006 at 60 cm above ground level as the majority of trees were below 1.3 m at that time.

Table 4. Ten year mean height (cm) and diameter (mm) at breast height (dbh) of all walnuts (stumped and not stumped) by species across both blocks. Height increment is also given for those walnuts not stumped.

	Stumped		Not stumped		
	Height	dbh	Height	dbh	Increment 2006-2012
MJ209	235	29	436	58	262
NG23	269	29	447	63	276
nigra	254	26	349	43	219
regia	319	29	391	54	222
mean	265	28	409	56	246

Table 5. Ten year mean walnut height (cm) of walnuts by stumping treatment, between two blocks.

	Not stumped		Stumped	
	Block 1	Block 2	Block 1	Block 2
MJ209	490	361	224	240
NG23	508	382	278	260
nigra	350	348	239	272
regia	430	352	319	320
mean	444	360	265	273

One year after stumping, both hybrids grew best when stumped in summer, but *both J. regia* and *J. nigra* responded better to a winter stumping (Clark 2009). However, in 2012, five years after stumping, the regrowth in block 2 (winter stumping) was marginally taller than regrowth in block 1 (summer stumping), although the difference was very small with the exception of *J. nigra* where regrowth was 14 % greater in block 2 (Table 5). Although walnut growth is better in block 1 than block 2 when not stumped, and regrowth of stumped walnut appears better in block 2 than block 1, it should be remembered that the regrowth of the summer stumping treatment (block 1) died in the first winter, so these walnuts took an extra 'hit' in the first year after stumping, although this does not appear to have affected overall regrowth to any significant degree.

Trees stumped in 2007 had five growing seasons before assessment of total height growth in 2012. The mean height of all walnuts stumped (regardless of species or block) was 265 cm (Table 5) whereas mean walnut height increment growth from the last measurement in 2006 (six growing seasons) was 246 cm. Thus, although total walnut height was less for the stumped walnuts, in five years they have put on greater height growth than the non-stumped walnuts, and have superior form with retained apical dominance (visual assessment only).

## Conclusion

Both hybrids grew better than either of the species in both block 1 and 2. This was not unexpected since both hybrids had been bred for improved growth. Stumping of walnuts with poor form has proved to be very successful with excellent survival and greatly improved form. The regrowth of the stumped walnuts was comparable to the increment growth of the non-stumped walnuts for the two hybrids. However, the two walnut species, *Juglans regia* and *J. nigra*, responded particularly well to stumping and regrowth was much greater than increment growth in the same period. Jaguar Lount Wood remains a good site for growing quality walnut.

## Management of Trials

The trials were in good order, and the walnuts growing very well. Some of the trees (larch and alder) and shrub nurses, particularly the *Elaeagnus*, are encroaching on the walnuts which are beginning to lean towards the light. Some remedial action would be beneficial in cutting back where light is limiting. Cherry survival (not assessed in this report) was lower than desired, but the stems remaining were also growing well, and would benefit from formative pruning and a crown lift, to be carried out in summer. Some willow scrub is beginning to emerge in some plots. Forest Enterprise were informed of this in July 2013.

#### Diary notes:

1. Block 1, walnut species regia, reps 2 and 3 – the walnuts are suffering from some encroachment by larch which is competing.
2. Block 2, walnut species NG23 rep 5 – cut back Elaeagnus
3. Block 2, walnut species MJ209 rep 10 – cut back Elaeagnus  
Block 2, walnut MJ209 rep 11 – willow coming in  
  
Block 2, walnut MJ209 rep 17 – cut back Elaeagnus
4. Block 2, walnut nigra, rep 15. Check alder
5. Block 2, walnut regia rep 2 – cherry could do with pruning  
Block 2, walnut regia rep 7 – cut back Elaeagnus.

### Appendices

Layout of the walnut silviculture trial at Lount Wood.

### References

Clark JR and Russell K. 2007. Forest Research Report 2006: walnut trials at Lount Wood, National Forest

Clark JR 2009. Forestry Research Report 2008: walnut trials at Lount Wood, National Forest.

Clark JR and Brocklehurst M. 2011. Stumping in Walnut. Quarterly Journal of Forestry. 105: 275-279



Appendix: Layout of the walnut Silviculture trial at Lount Wood.

**Block 1** northern field of Phase 2

1 MJ209 + ALDER + ELAEAG	2 MJ209 + CTRL	3 MJ209 + LARIX + ELDER	4 MJ209 + ALDER + NONE	5 MJ209 + BIRCH + ELAEAG	6 MJ209 + LARIX + ELAEAG	1 REGIA + CHERRY + ELAEAG	2 REGIA + ALDER + HAZEL	3 REGIA + LARIX + HAZEL	4 REGIA + BIRCH + HAZEL	5 REGIA + ALDER + ELAEAG	6 REGIA + CHERRY + HAZEL
12 MJ209 + BIRCH + HAZEL	11 MJ209 + LARIX + NONE	10 MJ209 + CHERRY + ELAEAG	9 MJ209 + ALDER + ELDER	8 MJ209 + LARIX + HAZEL	7 MJ209 + CHERRY + ELDER	11 REGIA + CHERRY + NONE	10 REGIA + LARIX + ELAEAG	9 REGIA + BIRCH + NONE	8 REGIA + CHERRY + ELDER	7 REGIA + BIRCH + ELDER	
13 MJ209 + CHERRY + NONE	14 MJ209 + ALDER + HAZEL	15 MJ209 + BIRCH + NONE	16 MJ209 + CHERRY + HAZEL	17 MJ209 + BIRCH + ELDER	12 REGIA + LARIX + NONE	13 REGIA + ALDER + NONE	14 REGIA + ALDER + ELDER	15 REGIA + CTRL	16 REGIA + LARIX + ELDER	17 REGIA + BIRCH + ELAEAG	
1 NG23 + BIRCH + NONE	2 NG23 + BIRCH + ELDER	3 NG23 + BIRCH + HAZEL	4 NG23 + LARIX + NONE	5 NG23 + CHERRY + HAZEL	6 NG23 + ALDER + NONE	1 NIGRA + LARIX + ELAEAG	2 NIGRA + BIRCH + ELAEAG	3 NIGRA + ALDER + ELDER	4 NIGRA + ALDER + ELAEAG	5 NIGRA + ALDER + HAZEL	6 NIGRA + BIRCH + HAZEL
12 NG23 + CTRL	11 NG23 + CHERRY + ELAEAG	10 NG23 + BIRCH + ELAEAG	9 NG23 + LARIX + ELAEAG	8 NG23 + CHERRY + NONE	7 NG23 + CHERRY + ELDER	11 NIGRA + LARIX + NONE	10 NIGRA + CTRL	9 NIGRA + ALDER + NONE	8 NIGRA + CHERRY + NONE	7 NIGRA + CHERRY + HAZEL	
13 NG23 + ALDER + HAZEL	14 NG23 + ALDER + ELAEAG	15 NG23 + LARIX + HAZEL	16 NG23 + ALDER + ELDER	17 NG23 + LARIX + ELDER	12 NIGRA + BIRCH + ELDER	13 NIGRA + CHERRY + ELAEAG	14 NIGRA + CHERRY + ELDER	15 NIGRA + LARIX + ELDER	16 NIGRA + BIRCH + NONE	17 NIGRA + LARIX + HAZEL	

**Block 2** southern field

1 REGIA + ALDER + HAZEL	2 REGIA + BIRCH + ELDER	3 REGIA + CHERRY + ELDER	4 REGIA + ALDER + ELDER	5 REGIA + BIRCH + ELAEAG	6 REGIA + CHERRY + HAZEL	1 NIGRA + CHERRY + ELDER	2 NIGRA + CTRL	3 NIGRA + LARIX + NONE	4 NIGRA + CHERRY + HAZEL	5 NIGRA + CHERRY + ELAEAG	6 NIGRA + LARIX + ELAEAG		
12 REGIA + BIRCH + NONE	11 REGIA + CHERRY + ELAEAG	10 REGIA + LARIX + ELDER	9 REGIA + LARIX + NONE	8 REGIA + CTRL	7 REGIA + LARIX + ELAEAG	11 NIGRA + ALDER + HAZEL	10 NIGRA + LARIX + ELDER	9 NIGRA + BIRCH + ELAEAG	8 NIGRA + LARIX + HAZEL	7 NIGRA + ALDER + ELDER			
13 REGIA + LARIX + HAZEL	14 REGIA + BIRCH + HAZEL	15 REGIA + ALDER + NONE	16 REGIA + ALDER + ELAEAG	17 REGIA + CHERRY + NONE	12 NIGRA + CHERRY + NONE	13 NIGRA + ALDER + ELAEAG	14 NIGRA + BIRCH + HAZEL	15 NIGRA + ALDER + NONE	16 NIGRA + BIRCH + ELDER	17 NIGRA + BIRCH + NONE			
13 MJ209 + BIRCH + HAZEL	14 MJ209 + ALDER + ELAEAG	1 MJ209 + ALDER + NONE	2 MJ209 + CHERRY + ELDER	3 MJ209 + LARIX + NONE	4 MJ209 + BIRCH + NONE	5 MJ209 + CTRL	6 MJ209 + LARIX + ELAEAG	1 NG23 + ALDER + ELAEAG	2 NG23 + ALDER + HAZEL	3 NG23 + ALDER + NONE	4 NG23 + CHERRY + NONE	5 NG23 + CHERRY + ELAEAG	6 NG23 + BIRCH + HAZEL
15 MJ209 + ALDER + HAZEL	16 MJ209 + ALDER + ELDER	17 MJ209 + BIRCH + ELAEAG	12 MJ209 + CHERRY + HAZEL	11 MJ209 + LARIX + HAZEL	10 MJ209 + CHERRY + ELAEAG	9 MJ209 + LARIX + ELDER	8 MJ209 + BIRCH + ELDER	7 MJ209 + CHERRY + NONE	11 NG23 + BIRCH + NONE	10 NG23 + LARIX + ELDER	9 NG23 + LARIX + ELAEAG	8 NG23 + LARIX + NONE	7 NG23 + ALDER + ELDER
						12 NG23 + BIRCH + ELAEAG	13 NG23 + CTRL	14 NG23 + LARIX + HAZEL	15 NG23 + CHERRY + HAZEL	16 NG23 + CHERRY + ELDER	17 NG23 + BIRCH + ELDER		