

WALNUT (*JUGLANS REGIA*) SEED-COLLECTING EXPEDITION TO KYRGYZSTAN IN CENTRAL ASIA

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SUMMARY

Kyrgyzstan in Central Asia contains ancient natural forests of walnut, *Juglans regia*, and is situated at the northern extent of the species' natural range. The walnut forests grow at a high altitude relative to that of lowland Britain. As damage by late spring frosts is one of the species' main problems in the UK, Kyrgyzstan and its walnut forests were the ideal location to target for an intensive seed-collecting expedition in the autumn of 1997. Eleven provenances were sampled in the south and west of Kyrgyzstan; nine were collected from the Fergansky mountain range and two were collected from the Sary-Chalek Biosphere Reserve in the Chatkalsky mountains. Some 253 different parent trees were sampled, collecting a total of 2,349 seed.

The expedition to Kyrgyzstan was undertaken in September and October 1997 as part of the my DPhil project at the University of Oxford, whose ultimate aim is to improve the form of walnut as a timber tree in the UK. The objectives of the project are: to study the silviculture of the common walnut, *Juglans regia*; to undertake seed collections from throughout the species' natural and current ranges; to analyse the genetic variation in these populations; and to establish a provenance trial in the UK.

The time and cost constraints of any research project inevitably mean that boundaries have to be drawn and, therefore, my research is concentrating on the common walnut. There are other walnut species with potential for good timber production, including the black walnut, *Juglans nigra*, and a hybrid between the two species. There has been more research into the latter two, particularly by our European cousins, than for the common walnut, which I believe has the greatest potential for improvement as a timber tree.

Most foresters know that common walnut is site-demanding, often of poor form and is particularly prone to damage by late spring frosts. The collection of provenances and the subsequent genetic studies and selections within this research project will address these problems. Pessimists among you should bear in mind that this is the first time that such a programme has been undertaken, so don't write the species off yet!

The natural range of common walnut extends from Nepal in the east, across Central Asia, to the troubled countries of Kurdistan, Georgia and Armenia, and as far west as Turkey. Kyrgyzstan, in Central Asia, lies at the heart of the origin of the common walnut and as such was the most desirable location to undertake an intensive seed collection with accompanying detailed scientific measurements. The country lies at the most northerly limit of the species' natural range and, although this is 10 deg south in latitude from southern Britain, the average elevation is just

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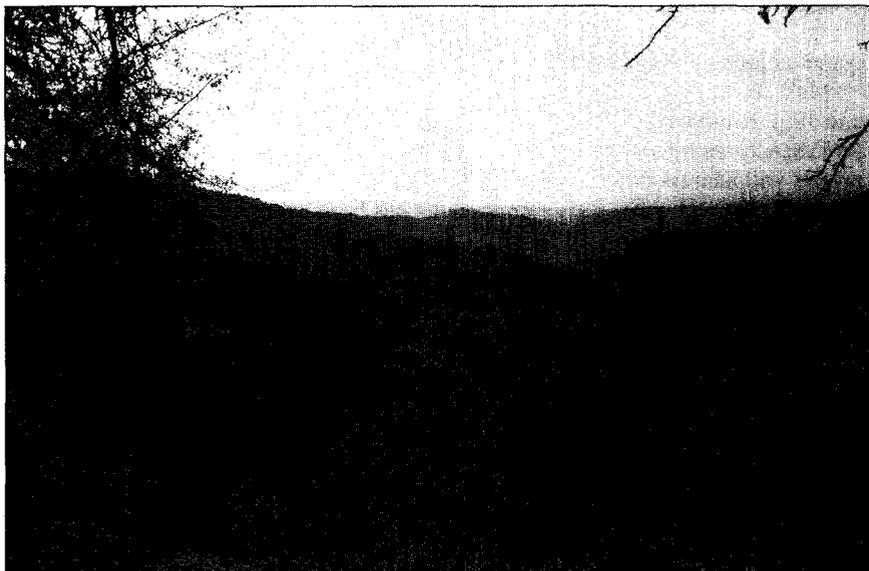
The expedition was generously funded by the Northmoor Trust and the RFS's Randle Travel Fund. Gabriel Hemery is employed as the forestry research manager for the Northmoor Trust and is completing a DPhil at the University of Oxford. The Northmoor Trust has strong links with the Forestry Commission, Horticulture Research International and the newly-formed British Hardwood Improvement Programme. Mr Hemery is the secretary of the walnut working group of the BHIP, which is looked at in an article in the next issue of the Journal.

under 3,000 m. To complete the provenance collections, forestry colleagues from Russia, Ukraine, Caucasus, Spain, Tajikistan, Iran, Nepal, Turkey, Romania, Slovakia, Hungary, Italy, Germany, France and the UK have collected seed from their respective countries.

After many months of planning, negotiating visas and obtaining permission for everything conceivable in this former Soviet province, my colleague and academic supervisor from Oxford, Peter Savill, and I left the UK on 20 September 1997. We were bound for Bishkek, the capital of Kyrgyzstan, via Istanbul in Turkey and Almaty in Kazakstan. For many months we had been explaining to our friends and colleagues that it was not 'Kurdistan' but 'Kyrgyzstan' which we were planning to go to: a laborious stress of the 'g' in Kyrgyzstan still often drew a familiar blank response. Finally, a good explanation seemed to be that it was somewhere north of Pakistan and that it bordered on to China.

Travelling to Kyrgyzstan took some 20 hours, including several flight delays. Three days later – after many failed promises – our luggage arrived, having been 'lost' in Kazakstan. Undeterred, we used the time to extend our visas and to complete other seemingly-needless bureaucratic exercises.

With clean clothes on our backs, we left the capital in the north and flew by Yak 40 over some of the spectacular mountains which cover 94 per cent of this small country, arriving in the second city, Osh, in the south. Our jeep and driver arrived, after we waited patiently for two hours, to take us to the home of a local forestry employee deep in the Fergansky mountains in the heart of the walnut-fruit forest area. The twilight drive was our first fascinating glimpse of the real countryside of Kyrgyzstan; the fields were full of maize, tobacco, cotton and food crops.



Looking south from a ridge top at 1,860 m above sea level, on the edge of an Ak-Terek provenance. Pure walnut forest extends as far as the eye can see.



Measuring a walnut stem diameter at breast height. The author is standing on a substantial root burr. Note the sprouting coppice-type regrowth.



Tree 16 at the Kyr-Sai provenance in the Sary-Chalek Biosphere Reserve at 1,320 m altitude. The tree is 26 m tall, is 17.7 m to first branch, has a dbh of 36.7 m and a straightness rank of 26.

The geography of the region necessitated a drive across an intrusion of Uzbekistan marked at both ends by formidably stern border guards, which could have been lifted from a Cold War film set. We were told to sit back in the jeep and to keep quiet! After three hours of bone-shaking roads, we left their comfort for steep dirt tracks as it got dark, climbing constantly for another hour, finally arriving at our host's home at midnight. We were met with a table laden with fresh fruit, home-made bread, honey and jam, chi (tea) and vodka. I knew that waking up to our new surroundings would be an experience.

We were staying at an altitude of about 1,300 m in the heart of the walnut-fruit forest area. We were perfectly located to sample the walnut forests, as we found out the first morning when we were driven up to a nearby ridge. In every direction, over the rolling mountains and valleys, stretched continuous forest of walnut at 1,000-2,000 m altitude. At the upper limits, the forest turned to scrub, sometimes with juniper, and rising beyond these were towering grey and barren mountains. The walnut-fruit forests consist almost entirely of walnut as the canopy tree, with *Crataegus*, *Prunus*, *Malus* and *Acer* as the understorey. These forests are also the origin of many of our domesticated fruits.

An efficient routine of collecting seed for our provenance collections was quickly

established and the days – full with work – sped by. We collected one complete provenance in a day which consisted, on average, of 23 parent trees' seed. Usually 10 seeds were collected from each tree, which gave us about 250 seeds per provenance. However, we were soon to discover that seed yields were very low in certain areas because the area had been hit by late spring frosts and had been subjected to a dry summer. We collected from different altitudes and aspects, with some combinations of these factors exacerbating the low seed yields.

Every parent tree was measured in detail, including total tree height, height to first branch, dbh, branching angle, crown diameter and stem straightness. The presence or absence of burrs was recorded, as was coppice form. Leaf and nut shapes were scored; the nuts were also measured for width and length. Each provenance site was located accurately for latitude and longitude using a hand-held GPS (Global Positioning System), and altitude and aspect were recorded. The soil texture was analysed using a simple hand-rubbing method.

Progress in collecting was slow because of the nature of obtaining seed, which was often by throwing sticks high into the canopy, and due to the terrain, which consisted of slopes close to 40 deg in some areas. The woods are used extensively by the local population, in striking contrast with our woodlands in the UK. I remarked to Dr Savill that we were probably witnessing scenes reminiscent of our woods more than 200 years ago. There were people everywhere, even in the remotest and most inhospitable regions, usually camped in the forest with their family and animals; there to harvest the walnut crop. Nuts were, therefore, rarely to be found on the ground in these areas.

I carried small boxes of Smarties in my rucksack as gifts for local children and these were always gratefully received. On one morning, deep in the walnut forest on a steep slope, we were approached by a man carrying a large bowl of natural yoghurt and another smaller one of fresh cream. They were placed on our makeshift tablecloth and then he left us, returning to the valley below. Such generosity was commonplace. Indeed the same morning, after struggling to return to our work with full stomachs, I made the apparent mistake of handing a box of Smarties to a child. Instantly, her mother, who I hadn't seen, went charging down the hill shouting something in Kyrgyz. I feared that I had made a dreadful mistake but our translator informed us that she was running to her tent to get us some yoghurt: we shouted "no" in several languages and were relieved to see that she stopped short of the tent!

In total, 11 provenances were sampled; nine were collected from the Fergansky mountain range and two were collected from the Sary-Chalek Biosphere Reserve in the Chatkalsky mountains. Some 253 different parent trees were sampled to collect a total of 2,349 seed. Each seed was labelled individually so that it can be identified with its parent tree. The altitude of the different provenances ranged from 1,260 to 1,900 m above sea level. The soils were all of loam type, ranging from clay loam to sandy loam, whilst the slopes ranged from 5 to 40 deg.

In the different provenances the trees which were sampled had the following properties. Average tree heights ranged from 17 to 22 m, with the maximum heights ranging from 20 to 34 m. The height to the first branch averaged between 5 and 6 m, with the maximum length of clear stem ranging from 7 to more than 18 m; 45 per cent of trees sampled had 6 or more clear metres of stem. Stem straightness was equally impressive, with 40 per cent of the sampled trees having the equivalent of two 3 m straight logs or more (ie 4 m and 2 m logs etc) with one stem having 18

straight metres. Average dbh varied between sites from 30 to 60 cm, whilst maximum dbh ranged from 40 to 128 cm. Some 20 per cent of the trees sampled had burs and 21 per cent were of coppice origin.

The basal area of the walnut forests averages 20 sq m/ha, with tree numbers ranging between 80 and 100/ha. There are obvious signs of human influence in the forests, including coppicing and burr removal for veneers; the latter is said to be largely due to a British company working in the 1920s. We saw many old burr-removal wounds on the bases of the larger trees, now surrounded with substantial regrowth of burs on either side. Natural regeneration is rarely evident in terms of seedling trees and the forests appear to regenerate by natural coppicing, with the new stems growing rapidly to the canopy. The local population uses walnut logs and dead stems for firewood but there are few signs of any recent tree felling.

While in Kyrgyzstan we heard that there was an American logging company operating in the south, apparently taking selective cuts in areas of natural forest. We later learned that there appears to have been some major misunderstandings in the original agreement, which was a 25-year contract, not least in that all except sanitary cuts are banned in these forests. The Kyrgyz now find that they cannot honour the timber-supply rate of the contract. The agreement was apparently signed without a representative from the government forestry bodies being there to explain these details!

The walnut seed – now safely back in the UK – was stored over winter before being propagated and planted out in a nursery in the spring of 1998. During this summer, the leaves of each transplant will be used in the genetic analysis of the different provenances, using isozyme analysis. This should indicate the amount and distribution of genetic variation in the species and its populations.

The seedlings may be large enough by the autumn of 1998 to lift and plant in a provenance trial at Paradise Wood; the new woodland and centre for genetic tree improvement managed by the Northmoor Trust in south Oxfordshire. The trial will include the other provenance collections from across Asia and Europe and should develop into a fascinating study of the species. Observations from the trial will be used in conjunction with the information gained from the original sampling expedition and from the genetic studies, to gain a greater understanding of this beautiful species and to improve its valuable utilisation in British forestry.