

Manure used by Europe's first farmers 8,000 years ago

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Partial ear of naked barley from Hornstaad-Hoernle, south-west Germany.
Credit: Ian Cartwright/Oxford University

(Phys.org) —A new study says Europe's first farmers used far more sophisticated practices than was previously thought. A research team led by the University of Oxford has found that Neolithic farmers manured and watered their crops as early as 6,000 BC.

It had always been assumed that manure wasn't used as a fertiliser until Iron Age and Roman times. However, this new research shows that

enriched levels of nitrogen-15, a stable isotope abundant in manure, have been found in the charred [cereal grains](#) and pulse seeds taken from 13 Neolithic sites around Europe.

The findings are published in the early edition of the journal *Proceedings of the National Academy of Sciences*. The study suggests that Neolithic farmers used the dung from their herds of cattle, sheep, goats and pigs as a slow release fertiliser for crops.

Manuring involves a long-term investment in arable land because dung breaks down slowly and crops benefit from its nutrients over many years. This new theory indicates a long-term approach to farming.

The authors conclude that early farmers recognised the inherent value of intensively managed land and sought to maintain it for their descendants. This new perspective overturns the traditional view held by scholars that Neolithic farmers were nomadic people who used slash and burn to create temporary farmland for [agricultural crops](#).

It is undisputed that the adoption of farming had a long-term impact on society. However, what has been unclear is the nature of early European farming and the role it has played in shaping social and economic change.

Lead author Dr Amy Bogaard from the School of Archaeology at the University of Oxford said: 'The fact that farmers made long-term investments such as manuring in their land sheds new light on the nature of early farming landscapes in Neolithic times. The idea that farmland could be cared for by the same family for generations seems quite an advanced notion, but rich fertile land would have been viewed as extremely valuable for the growing of crops. We believe that as land was viewed as a commodity to be inherited, social differences in early European farming communities started to emerge between the haves and

the have-nots.'

The territoriality of early farming groups may help to explain documented events of the period involving extreme violence. The study cites the example of a Neolithic mass burial of the late sixth millennium BC at Talheim, Germany, which preserves the remains of a community killed by assailants wielding stone axes like those used to clear the land.

The research is based on stable carbon and nitrogen isotope analysis of 124 crop samples of barley, wheat, lentil and peas, totalling around 2,500 grains or seeds. The charred remains represent harvested crops preserved in Neolithic houses destroyed by fire. The samples were from archaeological excavations of Neolithic sites across Europe, dating from nearly 6,000 to 2,400 BC.

The study also has important implications for research into the diet of early farmers. Archaeologists rely on the stable isotope analysis of the skeletal remains to establish a signature, which provides information about what people once ate. The heavier [stable isotope](#) of nitrogen-15 found in manure mimics the isotopic effect of a diet rich in meat and milk.

It had been assumed that early farmers in northwest Europe had a diet full of animal protein. However, these results suggest that the protein from cereal and pulse crops is much higher than previously thought, and that Neolithic crops were a staple part of their diet.

The crop nitrogen isotope analysis suggests that early farmers in Europe used their manure strategically as a resource that was limited by the number of animals they owned and by the physical effort of hauling manure around. The study points out that there is evidence that the [farmers](#) carefully selected crops that would most benefit from fertiliser, leaving hardier crops to grow with little or no manure. This demonstrates

a knowledge of growing crops that has been little acknowledged until now.

The cereal and pulse samples were taken from sites spread across Europe: in the UK, they included Hambledon Hill in Dorset and Lismore Fields near Buxton in Derbyshire. Other Neolithic sites included in the research were in Greece, Bulgaria, Germany and Denmark.

More information: Crop manuring and intensive land management by Europe's first farmers,

www.pnas.org/content/early/2013/07/10/1305918110

Provided by Oxford University

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