



Standard Contract for Goods and/or Services - Order Form

1. Purchase Order Number	Not known	
2. Customer	Natural England	
3. Contractor(s)	RSK ADAS	
4. Defra Group Members	The following Defra Group members will receive the benefit of the Deliverables: Natural England, Defra, Environment Agency	
5. The Agreement	<p>This Order is part of the Agreement and is subject to the terms and conditions referenced at Appendix 1 and shall come into effect on the Start Date.</p> <p>Unless the context otherwise requires, capitalised expressions used in this Order have the same meanings as in the terms and conditions.</p> <p>The following documents are incorporated into the Agreement. If there is any conflict, the following order of precedence applies (in descending order):</p> <ul style="list-style-type: none">a) this Order;b) the terms and conditions at Appendix 1; andc) the remaining Appendices (if any) in equal order of precedence.	
6. Deliverables	Applicable Deliverables	Goods Only: <input type="checkbox"/> Services Only: <input checked="" type="checkbox"/> Good and Services: <input type="checkbox"/>
	Goods	NA
	Services	<p>Description: To carry out the services as set out in Appendix 2 – Specification / Description</p> <p>To be performed at the Contractor's premises (To note contractor to be confirmed)</p> <p>Date(s) of Delivery: The period of 25 weeks: commencing 07/10/2024 to 28/03/2024.</p> <p>Work activities to be performed subject to contractor's discretion.</p>
7. Start Date	07/10/2024	

8. Expiry Date	28/03/2024						
9. Charges	The Charges for the Goods and/or Services shall be as set out in Appendix 3 – Charges. The Charges are fixed for the duration of the Agreement.						
10. Payment	Payments will be made to the successful contractor, with payments being made in pounds by BACS transfer using the details provided by the supplier on submission of a compliant invoice.						
11. Contractor’s Liability Cap (Clause 13.2.1)	A sum equal to £5,000,000.						
12. Customer’s Authorised Representative(s)	For general liaison your contact will continue to be Redacted under FOIA Section 40 Personal Information						
13. Contractor’s Authorised Representative	For general liaison your contact will continue to be Redacted under FOIA Section 40 Personal Information						
14. Optional Intellectual Property Rights (“IPR”) Clauses	The Customer has chosen Option B in respect of intellectual property rights provisions for the Agreement, as set out in the terms and conditions, which can be downloaded from the link in Appendix 1 – Terms and Conditions.						
15. Progress Meetings and Progress Reports	<ul style="list-style-type: none">The Contractor shall attend progress meetings with the Customer every month from October 2024 to March 2025.						
16. Address for notices	Customer: Natural England Contractor: Redacted under FOIA Section 40 Personal Information						
17. Key Personnel of the Contractor	<table><tr><td>Key Personnel Role:</td><td>Key Personnel Name:</td><td>Contact Details:</td></tr><tr><td colspan="3">Redacted under FOIA Section 40 Personal Information</td></tr></table>	Key Personnel Role:	Key Personnel Name:	Contact Details:	Redacted under FOIA Section 40 Personal Information		
Key Personnel Role:	Key Personnel Name:	Contact Details:					
Redacted under FOIA Section 40 Personal Information							

18. Procedures and Policies	The customer's policy relating to sustainability is outlined in the specification below in Appendix 2
19. Special Terms	NA
20. Additional Insurance	NA
21. Further Data Protection Provisions	The further data protection provisions contained within Annex 4 of the terms and conditions are applicable to this Agreement where indicated below: Yes: <input type="checkbox"/> No: <input checked="" type="checkbox"/>

Signed for and on behalf of the Customer	Signed for and on behalf of the Contractor
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Redacted under FOIA Section 40 Personal Information

Appendix 1: Terms and Conditions

The Customer's Standard Good & Services Terms and Conditions which can be located on the [Natural England Website](#) and which are called 'Standard goods and services terms and conditions (£10,000 to £50,000)' and can be downloaded using [this link](#).

Appendix 2: Specification/Description

Specification of Requirements

Background to Natural England

Natural England is the government's advisor on the natural environment. We provide practical advice, grounded in science, on how best to safeguard England's natural wealth for the benefit of everyone.

Our remit is to ensure sustainable stewardship of the land and sea so that people and nature can thrive. It is our responsibility to see that England's rich natural environment can adapt and survive intact for future generations to enjoy.

Natural England's purpose is to ensure that the natural environment is conserved, enhanced and managed for the benefit of present and future generations, thereby contributing to sustainable development.

This purpose includes:

- promoting nature conservation and protecting biodiversity
- conserving and enhancing the landscape
- securing the provision and improvement of facilities for the study, understanding and enjoyment of the natural environment
- promoting access to the countryside, open spaces and encouraging open air recreation
- contributing in other ways to social and economic wellbeing through management of the natural environment

Integrating mycorrhiza into nutrient management planning

Background to the specific work area relevant to this purchase

This specification relates to work to be carried out for Natural England's Geology, Landscape and Soils Team, and aims to provide evidence to support the government's ambitions to deliver sustainable management for 60% of agricultural soils by 2030. The project requires a literature review to gather and synthesis knowledge relating to whether and how our current understanding of mycorrhizal nutrient supply can be integrated into nutrient management planning. Mycorrhizal fungi have been forming mutualistic associations with terrestrial plants since they first began to spread onto land, and provide nutrients, water and disease resistance to the plants, in return for photosynthetic carbon. The mutualism, however, is abandoned by the plant in circumstances of high mineral nutrient availability, such as is promoted under currently encouraged nutrient application rates. Besides supporting plants mycorrhizal fungi also deliver significant benefits to soil carbon storage and soil coherence, helping to prevent erosion and sediment pollution. In order to secure ecosystem benefits from mycorrhizal fungi we need to understand whether and how we can advise farmers to encourage mycorrhizae in their crops, and what this would mean for farm nutrient management regimes. To achieve this aim, we need to collate and analyse existing data and understand where we have strong evidence to underpin management advice, and where there are key evidence gaps to resolve.

The work will take place between September 2024 and March 2025, and will deliver a report, a presentation and infographics to help communicate the findings.

Requirement

Rationale and Background

Mycorrhiza refers to a symbiotic association between fungi and plant roots, and this plays a pivotal role in delivering nutrient supply to plants. This mutualistic relationship has existed since the earliest land plants, effectively enabling their colonisation of land, and is crucial for the function of many ecosystems. Mycorrhizal fungi colonize plant roots and extend their hyphae into the soil, significantly increasing the surface area for nutrient and water absorption, while benefiting from, and often completely relying upon, photosynthetic carbon from the plant as an energy supply.

Mycorrhizal fungi improve the uptake of essential nutrients, particularly phosphorus (P), nitrogen (N), potassium (K), and micronutrients such as zinc (Zn) and copper (Cu). Phosphorus is often present in soil in insoluble forms as complexes with iron, aluminium or calcium, but becomes more accessible to plants through the enzymatic actions of mycorrhizal fungi. The extensive hyphal networks allow for the exploration of larger soil volumes, and soil particle surface areas, capturing nutrients beyond the reach of plant roots. They also act as conduits for water, which is transported along the external surfaces of the hyphae to the roots. Other plant benefits conferred by mycorrhiza include improved disease resistance, which is thought to result from both better health, as mediated by better nutrient and water supply, but also by the mycorrhizal priming the plant's defence mechanisms against pathogens. Mycorrhizal also help to shield plants from toxic elements in contaminated soils, and can preferentially support germination and recruitment of young plants, as well as representing a mechanisms whereby plants communicate environmental stresses between each other.

Besides the direct benefit to the plant, mycorrhizal fungi also contribute to the formation of stable soil aggregates both by enmeshment of aggregates with hyphae, and by production of structural glycoproteins which, when hyphae decay, are highly adhesive to soil particles, resistant to degradation and retentive of water and nutrient cations. The resulting soil aggregates provide an ideal growing medium for many plants, suggesting that this soil structure co-evolved with mycorrhizal mutualism, along with similar mutualistic associations between soil organisms and the plants which supply their energy. Furthermore, the carbon stored in mycorrhizal glycoproteins represents a huge store of terrestrial organic carbon, which helps to maintain climate stability.

Overall, mycorrhiza, as we'd expect from an ecological arrangement that has dominated the planet's terrestrial ecosystems for over 400 million years, are an integral part of the function of terrestrial ecosystems.

Modern conventional agriculture, however, has been developed largely independently from the concept of mycorrhiza, which were only discovered in the late 19th century, and not extensively studied until the mid 20th century. The agricultural "green revolution" that changed agriculture after the 2nd world war focussed on taking advantage of industrial chemical processes to generate readily available nutrients for crop plants, alongside further ranges of chemical tools to control pests and diseases. Drought or disease stress was also addressed by intensive breeding programmes which attempted to produce crops that maximised yield of the saleable

products, while providing adequate resistance to diseases and drought, with trials of new strains being assessed without consideration of their mycorrhizal characteristics. Physical advances in technology enabled more intensive irrigation using abstracted or groundwater, and the delivery of the open soil structure required by plant roots was seen to be the job of intensive mechanical tillage.

All these processes represent a technological approach to replace the natural functions delivered by mycorrhiza and other soil organisms. However, in replacing these functions, industrial agriculture also actively disadvantages mycorrhiza. Because the fungi require a contribution of C from the plant, there is a cost to the plant in maintaining this relationship, and plants have been shown to respond to abundance of accessible mineral forms of nutrients by abandoning the mycorrhizal partnership, thereby saving the energy cost of maintaining a mycorrhiza where alternative nutrient supplies are available. Application of pesticides can also adversely affect mycorrhiza. Many fungicides kill or damage mycorrhizal fungi, but other plant protection products such as herbicides can have adverse effects, too. For example, exposure to glyphosate can reduce the germination potential of mycorrhizal spores. Intensive cultivation and regular disturbance of the soil destroys the delicate network of fungal hyphae, so that any mycorrhiza forming must grow again, from spores or fragments, in between cultivations, while soil bacteria thrive. Finally, crop breeding has favoured strains which perform best under chemical fertiliser regimes, which has resulted in modern strains that may be ill-equipped or unable to form mycorrhizal partnerships, and the suite of modern agricultural practices described above, has resulted in crop choices and food types that are inherently non-mycorrhizal (e.g. brassicas, beets) being bred from plants that thrive in disturbed habitats.

If we are to tackle the widespread environmental challenges facing us – pollution, climate change, biodiversity decline, food security – the integration of mycorrhiza into the way we grow our food will be a vital part of the solution.

However, current government-sponsored nutrient planning advice does not recognise the possibility of nutrient supply from mycorrhiza. The recommendations for application of mineral nutrients seek to supply all the requirements of the crop, topping up the available mineral nutrient supplied by the soil, and include a buffer for some possible nutrient loss. The resulting soil nutrient regime is therefore likely to encourage any plants capable of forming mycorrhizal associations to abandon them, with likely deleterious results for soil structure, disease, pollution, and climate change. This regime is likely to have contributed to declines in water and environmental quality.

We urgently need to review and apply knowledge of how mycorrhiza work in agroecosystems, to enable us to take advantage of their ability to take advantage of stable, plant-inaccessible nutrients to enable us to reduce nutrient application, loss, transport and production, while providing a wide range of associated ecosystem benefits.

Approach

This project aims to review the current knowledge of the occurrence of mycorrhiza in agroecosystems, and develop conclusions and recommendations on how farm management can best encourage and take advantage of mycorrhizal function. Specifically we would like the review to explore:

A review of the key mycorrhizal crops for current and future UK agriculture, and their mycorrhizal symbionts, identifying those naturally present in UK soil and those requiring inoculation.

Tipping points in nutrient application regimes that encourage mycorrhizal or non- mycorrhizal nutrient acquisition by these crops, and the likely impact of reliance on mycorrhiza on nutrient supply, and crop yield and profitability.

The benefits of crop inoculation against practices which develop mycorrhizal diversity in the soil.

The identification of farm system practices which may be necessary to enable a switch to mycorrhizal nutrient supply – considering cultivation, agrochemicals, crop choice (strains, alternatives to non-mycorrhizal crops), cover cropping, weed control, etc.

A conceptual exploration of whether the wider ecosystem services delivered by mycorrhiza in agroecosystems justify societal payments to encourage the practice and buffer unpredictability.

Key conclusions and recommendations, ideally highlighting any which can be included in future government nutrient planning advice, and identifying key evidence gaps where rapid research could enable development of new advice and guidance on this topic

We envisage this work to include a literature review, and where appropriate, limited meta-analysis, to encompass studies of crops and systems suited to the UK's current and near-future climate, as well as studies elucidating the mechanisms of mycorrhizal symbioses on suitable crop plants. We expect the contractor to access both published and "grey" literature.

Deliverables

We require that the project deliver:

A written literature review, in Natural England's standard report format, in a structure suitable for adaptation for submission to a peer reviewed journal. This report should include:

a brief rationale and background for the project.

a clear description of the approaches taken to identify and review evidence sources

systematic review of meta-analysis results where appropriate

a full referenced bibliography

metrics and figures showing the synthesis of data from any meta-analyses

tabulated results from any systematic collation of studies.

recommendations for advice which can be currently given to farmers on how to manage, and benefit from, mycorrhizal supply of nutrients, where the evidence base is strong, along with an indication of its likely impacts of following this advice on management requirements, yield, and farm profitability.

Identification of evidence gaps, especially where additional research would be needed to provide robust evidence-based advice on how to manage mycorrhizal crops for reduced nutrient inputs and enhanced crop and ecosystem benefits.

A 20-minute presentation, suitable for delivery at a soil health conference (such as that held in Sheffield by Natural England in July 2024), explaining the project's rationale, approach, results, and conclusions.

One or more infographics which can be used to rapidly communicate the project (graphical abstract).

All data collated from studies (if meta-analysis carried out), which should be supplied to Natural England in the form of an excel spreadsheet, along with any appropriate metadata, including any onward licencing agreements in place relating to that data.

Skills required

We would expect the successful contract to have expertise in:

- Mycorrhizal fungi, and their function

- Plant physiology

- Agricultural management

- Crop nutrition

- Literature review (including Meta-analysis and Systematic Review)

The successful contractor would benefit from additional expertise in:

- Agricultural economics

- Wider soil biology

- Regenerative agriculture

Project Management

As part of their tender, we require that potential contractors submit:

- A project risk assessment, which should identify risks to successful delivery of the project, and suggest appropriate mitigation actions, along with who would be responsible for delivering these.

- A description of the qualifications and experience of all key personnel delivering this project, and why they are suitable to deliver the role.

- A simple Gantt chart identifying key milestones for delivery, who would be responsible for specific milestones, and highlighting any interdependencies in the project's delivery.

It is not envisaged that the project will involve any fieldwork or significant travel. The successful contractor is invited to consider whether liaison with experts or industry (e.g. suppliers of mycorrhizal inoculants) would be beneficial to the project and engage with these if necessary, however, the conclusions of this report should be based on robust evidence, rather than expert opinion.

It is envisaged that the work to be undertaken for this project will take approximately **60 staff days**.

Sustainability

Natural England protects and improves the environment and is committed to reducing the sustainability impacts of its activities directly and through its supply chains. We expect the Contractor to share this commitment and adopt a sound, proactive sustainable approach in keeping with the 25 yr environmental plan/our commitments compliant with all applicable legislation. This includes understanding and reducing direct and indirect sustainability impacts and realising opportunities, including but not restricted to; resilience to climate change, reducing

greenhouse gas emissions, water use and quality, biosecurity, resource efficiency and waste, reducing the risk of pollution, biodiversity, modern slavery and equality, diversity & inclusion, negative community impacts.

As a delivery partner, the successful contractor is expected to pursue sustainability in their operations, thereby ensuring the Contracting Authority is not contracting with a supplier whose operational outputs run contrary to the Contracting Authority's objectives. The successful contractor will need to approach the project with a focus on the entire life cycle of the project

Outputs and Contract Management

The table below provides a suggested project outline and dates for key deliverables. The contractor, however, is asked to provide their own project outline, reflecting their delivery capabilities and plans.

	Project initiation meeting		Sept 2024
	1st project meeting		Oct 2024
	Delivery of outline report structure.		Early Nov 2024
	2nd project meeting		Nov 2024
	3rd project meeting		Dec 2024
	4th project meeting		Jan 2025
	5th project meeting		Feb 2025
	Delivery of draft report		
	Meeting to discuss draft report		15 Mar 2025
	Final project wrap-up meeting		End Mar 2025

The project will be managed by Jonathan Griffiths and Matthew Shepherd for Natural England, with regular (at least monthly) online meetings organised by the contractor, to provide updates and clarify issues and risks. Any risks identified by the contractor to the delivery of this project should be raised as early as possible by email or telephone to the project manager. All deliverables will be supplied as electronic copies. We would value suggestions from the contractor on how best to proceed with publication of the report, or a paper closely derived from it, in a peer reviewed academic journal.

Appendix 3: Charges

Descriptions of Tasks and / or Products	Cost per product / or Cost per Hour / Day (i.e. rate)	No of Days	Total Cost per Task
Redacted under FOIA Section 43 Commercial Information			
Total Overall Cost (excluding VAT)			£31710.50

Appendix 4: Processing Personal Data

Contract:	
Date:	
Description of authorised processing	Details
Identity of Controller and Processor for each category of Personal Data	
Subject matter of the processing	
Duration of the processing	
Nature and purposes of the processing	
Type of Personal Data	
Categories of Data Subject	
Plan for return and destruction of the data once the processing is complete UNLESS requirement under law to preserve that type of data	
Locations at which the Contractor and/or its subcontractors process Personal Data under this Agreement	
Protective Measures that the Contractor and, where applicable, its subcontractors have implemented to protect Personal Data processed under this Agreement against a breach of security (insofar as that breach of security relates to data) or a Personal Data Breach	