



Agriculture & Horticulture  
DEVELOPMENT BOARD



# **Grower Summary**

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## **FV 398**

Over-winter carrot storage: a  
review of future opportunities

Final 2011

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If you would like a copy of the full report, please email the HDC office ([hdc@hdc.ahdb.org.uk](mailto:hdc@hdc.ahdb.org.uk)), quoting your HDC number, alternatively contact the HDC at the address below.

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HDC is a division of the Agriculture and Horticulture Development Board.

**Project Number:** FV 398

**Project Title:** Over-winter carrot storage: a review of future opportunities

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**Contractor:** Vegetable Consultancy Services (Developments) Ltd.

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**Report:** Final report, 2011

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**Previous report/(s):** -

**Start Date:** 12<sup>th</sup> April 2011

**End Date:** 30<sup>th</sup> June 2011

**Project Cost:** £5,800

## Headline

- This project identifies the best approaches for supplying UK carrots through the winter/spring period.

## Background

Current UK industry practice is to field-store carrots in-situ under polyethene and straw for winter/spring marketing. However, this practice is under increasing threat from rising straw, plastic and land-rent prices and it also poses agronomic issues for long-term sustainable production. Despite these threats, there are no currently proven alternative winter storage solutions that satisfy the requirements of the UK market: providing produce with suitable skin finish and taste, with low levels of disease at an economically viable cost.

Therefore, this project aimed to identify and review both currently established and novel strategies or technologies for providing a reliable supply of quality carrots during the winter/spring/early summer. Each option was briefly evaluated for its suitability to the UK industry (compared to the current practice) including estimated costs. Those techniques or strategies with the greatest potential for the UK industry were identified for future targeted research through the HDC.

## Summary of the project and main conclusions

A combined approach was the best option for supplying UK carrots through the winter/spring period:

- Open ground with frost-tolerant varieties (+/- soil covering) for early supplies
- Polyethene + straw for mid-winter to late spring
- Refrigerated storage systems have potential, but require further adaptation / optimisation for the UK

Systems and techniques for supplying carrots in the “off-season” both from the UK and worldwide were collated and evaluated. Each method was summarised in a one-page data-sheet giving agronomic practices, harvesting techniques, storage method (if used), estimated

costings through the supply period, a summary of pros and cons and an overall assessment of the suitability of the strategy/technique for the UK market.

A full interpretation of the data collated in this study can be gained from the data-sheet series in the science section of the report. A summary of the results is provided below:

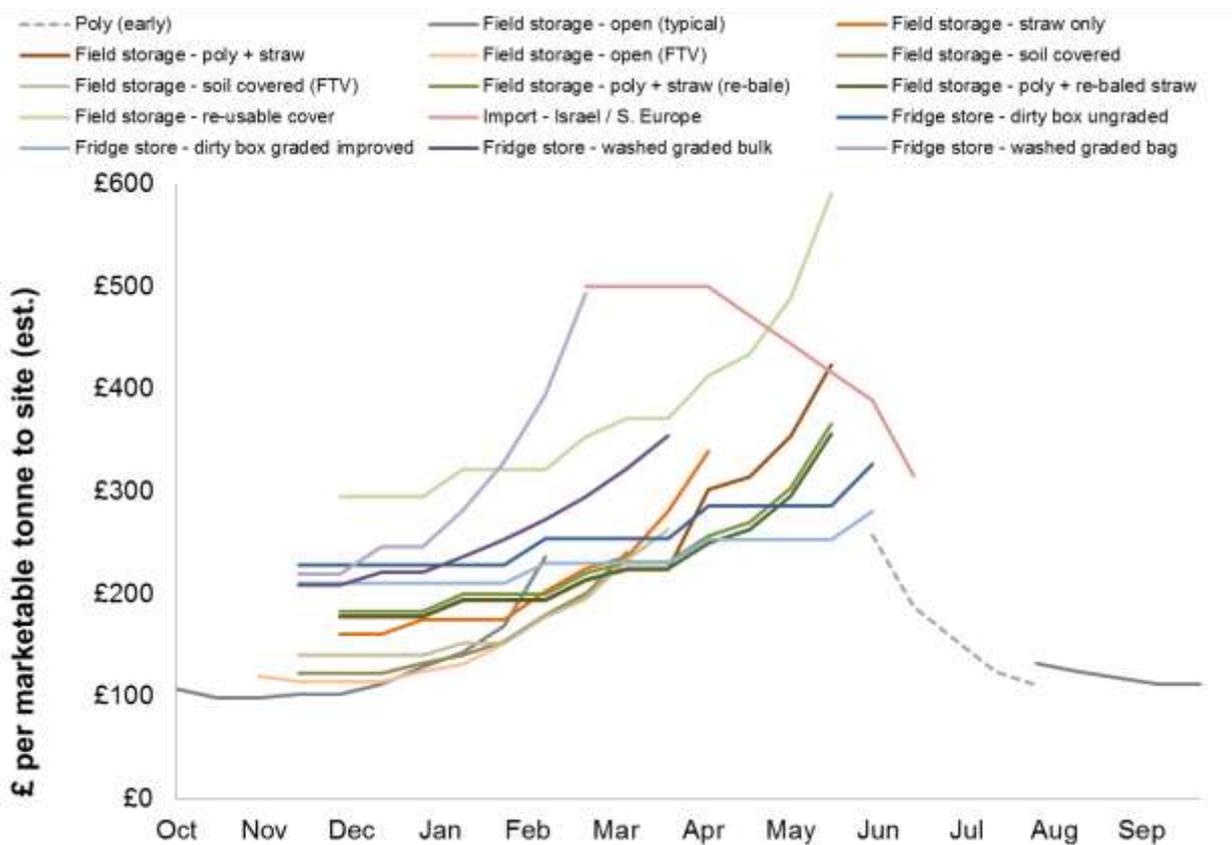
- There may be opportunities for greater use of open-ground or ridged soil storage, making use of some of the newer, more frost-tolerant varieties for supplies in the early/mid period (realistically only to January without significant risk).
- Field storage under straw (no polyethene) can be used for early winter supplies, but suffers from many of the drawbacks of standard polyethene and straw and can reduce flexibility in supply chain. Consequently, its use is likely to remain limited.
- The standard method of field storage under polyethene and straw (poly+straw) still appears to provide a reasonable (and familiar) solution to carrot supplies during the winter/spring, but retains its existing problems. Modifications of the system by re-baling straw may have some financial benefits if demand (and therefore price) for straw increases and supplies become limited. However, any economic benefits are currently quite marginal, other than helping to secure supplies.
- There appears to be no alternative insulating materials (either biodegradable loose materials or synthetic covers) available that provide suitable properties at an acceptable price. However, advances in manufacturing technology and bulk purchasing may alter the economics in future.
- Imported carrots during the off-season are currently a necessity in the majority of years when UK crop does not quite provide sufficient supplies of quality produce in the overlap between stored carrots and fresh poly carrots. However, imported produce is typically expensive, subject to volatile market prices and unlikely to provide a welcome alternative to UK supplies through a longer period.
- Refrigerated storage of dirty carrots in boxes (as practiced in N Europe) is generally a more expensive option than field storage under straw, although it may match price towards the end of the season (subject to quality at out-turn). Its use in the UK will be limited by the availability of silty soils for growing crop with minimal skin abrasion, by

the logistics of harvesting all winter crop during October/November and by the risk of entire store degradation.

- An alternative might be to modify the method, by pre-grading rejects in the field and employing state-of-the-art environmental control systems. This may bring some of the cost issues of box storage down to more realistic levels, but does not solve the shortfall in suitable soil types or other issues.
- The current practices of storing carrots washed and graded, either in bulk or in some form of perforated or basic modified atmosphere plastic bag do not appear to provide a solution to the UK issue.
- There are a number of developments in refrigerated carrot storage which may provide sufficient improvement in disease control and crop quality to allow refrigerated storage to compete better with poly+straw methods. Most of these technologies are not yet commercially tested on carrots:
  - Steam sterilisation of washed carrots using intelligent control system to reduce storage diseases
  - Hydrogen peroxide fogging to reduce storage diseases
  - Ethylene scrubbing (carrots are very sensitive to ethylene, either from other crops or from propane-powered forklift exhausts)
  - UVC sterilisation of washed carrots to reduce storage diseases
  - Modified atmosphere packaging (either in bulk bins, or in smaller units) – techniques for fine-tuning the balance between crop and pathogen respiratory requirements are much more advanced than with previous films.
  - The principles of modified atmosphere packaging could be applied on a whole-store scale
  - Large advances in environmental control units, both in how units operate (e.g. continuously on variable-speed drive, rather than on-off and improved knowledge of air circulation), and in more accurate control of temperature and RH (e.g. improved “dry” fogging systems)
  - Fungicide/chlorine rinses for washed produce may also help reduce disease issues (but regulatory and supermarket acceptance issues).

- It is suggested that these novel techniques are investigated in detail to determine their potential in developing refrigerated storage techniques suitable for the UK system.

Taking the available evidence to hand, it is suggested that drastic changes to current practice are not executed. However, it may be worth considering including some areas of alternative supply options within grower/packer supply chains to help manage costs and supplies through the winter/spring period. Examples include: open ground storage with frost tolerant varieties (in suitable location) for early winter supplies; straw, or more likely polyethene and straw for mid to late supplies (with or without some re-baling of used straw). Those with access to suitable soil types may wish to invest in dirty box stores, preferably with some pre-grading before store and the state-of-the-art environmental management systems, but this is only likely to provide a partial solution to winter/spring supplies. Lastly, work should continue to examine the potential of the emerging technologies to enhance existing storage techniques to be more suitable for the UK market in the future. A graphical summary of the estimated cost of each strategy / technique is given below.



### Cost comparison between all “off-season” carrot supply strategies or techniques

## **Financial benefits**

This project aimed only to collate and provide an information base around which further discussion on methods for supplying carrots in the winter/spring period could be centred.

However, as an example, there are indications that modifying current storage practice by including a range of alternative options (such as open ground or soil covered storage using frost-tolerant varieties) could result in cost savings of around £64 per marketable tonne delivered to factory in December, dropping to around £14 in February (but with increased risk of crop loss attached). Further, in-depth costings would need to be carried out for specific strategies/techniques to accurately estimate potential financial benefits.

## **Action points for growers**

Growers should actively consider their own off-season carrot supply strategies/techniques, paying particular attention to their specific circumstances (e.g. geography, soil base, varietal limitation, market requirement etc.).

It is suggested that the one-page data-sheets generated for in the full science report are used as a base-line for discussion and that further, in-depth investigations are carried out before changes are made to systems.