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JULY 2008 PRIMEFACT 802

Organic vegetable production - planning

Robyn Neeson

Organic Farming Liaison Officer, Farming Systems Research, Yanco

Planning is essential for the success of any farming enterprise. Organic farming enterprises in particular require careful planning prior to sowing any crops. This Primefact describes some of the important considerations when starting an organic vegetable enterprise.

Farm selection and establishment

Successful production of organic vegetables can be very dependent on site selection. Apart from all the obvious reasons for choosing a site – suitable soils and climate, a plentiful supply of good-quality water, access to labour, transport and markets, and so on – the site should be relatively free of the pests and diseases of the crops the producer hopes to grow. For example, there may be greater risks associated with growing organic vegetables in an area where large monocultures of similar crops are grown or in higher rainfall areas, where pests and disease may be more prevalent. If processing is an option, then access to a certified processor would be a consideration.

Starting small is usually a good idea. This helps to minimise risks and allows for developing the required skills. Successful organic vegetable production relies on establishing a sound rotation plan; this might mean reducing the scale of the area under commercial production and putting land aside for green manure cropping. This land is then brought into production in a subsequent rotation.

Variety and crop selection

Market suitability, physiological characteristics, pest and disease resistance, seed or seedling availability, and environmental suitability are all considerations when determining what variety of crop to plant. Since 31 December 2003 it has been a requirement of the National Standard for Organic and Biodynamic Produce that the chosen variety be obtained from organically certified seed or seedlings. The variety should also be popular in the marketplace, be high yielding, have good pest and disease resistance, and have good seedling vigour and canopy development in order to smother weeds. Some varieties have features – for example, hairs or a rough surface – that make them unattractive to pests.

Market suitability

Market research is essential for determining which vegetables are popular with consumers. Contact organic wholesalers, retailers and exporters and find out what is required and when it is required. Some types of vegetables might be under-supplied at particular times of the year, and it might be possible to fill that seasonal gap. Restaurants or caterers might want specialty vegetables – for example, ‘mini’ vegetables. Local markets or farm-gate sales might be a possibility, in which case growing a broad range of popular lines could be the best option. A vegetable processor is another possibility: organic baby food is being marketed by a number of processors in Australia and elsewhere. A study by the Queensland Department of Primary Industries found that there is an export market for frozen organic vegetables (Lakin & Shannon 1999).

Generally, there are preferred cultivars for processing and for the fresh-food market; this should be researched. Processors will probably have their own requirements, which could include variety, timing and quantity of supply, shape, or specific composition requirements such as the percentage of soluble solids in the product.

Environmental suitability

Once the decision has been made about what to grow, the next step is to choose a suitable cultivar. Do some ‘local’ research: contact the local agriculture department, producers and home gardeners to find out what performs well in the area. Soil type and seasonal characteristics such as day length and temperature range all influence what cultivars can be grown and when they can be grown. It may be possible to modify environmental factors to protect or change the maturity date of crops, using, for example, crop (or row) covers or glasshouse production.

Pest, disease and weed resilience

Among the variety features that will give an organic crop an advantage are inherited disease and pest resistance, seedling vigour, broad leaves (to shade out weeds) and 'hairy' fruit (as in some types of squash) to deter pests. Varieties selected on the basis of their maturity date can be planted to avoid periods of high pest and disease incidence.

Seed and seedling availability

Organic certification standards require that first preference be given to planting organically raised seeds or seedlings. Since 1 January 2004 this has been a requirement of the National Standard for Organic and Biodynamic Produce. An industry database of producers and suppliers of organic seed and seedlings is being developed. Open-pollinated and non-hybrid varieties are also preferred but not essential. Genetically modified (transgenic) cultivars are not permitted in organic systems.

Care should be taken to ensure that the seed has acceptable germination. A few seeds planted in a pot before sowing will give an indication of the germination percentage. Seed must not be treated with pre-sowing chemicals.

Designing the crop rotation

Perhaps the most crucial management decision for an organic vegetable farmer is the design of the cropping rotation, which should meet the farmer's production and financial needs while also implementing sustainable agricultural practices.

A number of aspects of rotation design need to be considered:

- the rotation sequence (temporal design) – crop choice and the timing of operations;
- the layout within a rotation (spatial design) – row spacing, sowing density and intercrop spacing;
- the relationship of the crop to other natural features on the farm – for example, location and design of shelter belts and insectaries to encourage the build-up of natural predators.

These design considerations greatly affect a producer's ability to effectively manage pests, weeds and diseases organically.

The rotation sequence

Factors that must be considered when deciding on the rotation design include the choice of vegetable crops and their relationship with one another, with fertility building and with pest and disease-breaking crops such as pastures and green manures. Other factors that should be taken into account are the market for the chosen crops, the available resources (for example, labour and equipment), the economics of the rotation and, if they are to be a part of the rotation, the role of livestock.

Rotation rules – temporal design

Although there are a number of rules that should be followed when designing a rotation, flexibility is a central consideration: there is no point sticking to a planned rotation if, for example, the market for a particular crop has slumped. When choosing crops for a rotation it is a good idea to have a number of uses in mind – say, processed or fresh – and in such a situation careful choice of variety is crucial. Organic certifiers might stipulate that in any three-year period at least one year should include a green manure crop, leguminous crop or pasture phase. This might not be required if compost is regularly applied for primary fertility building or where livestock are incorporated in the system.

Generally, however, the following rules should be applied.

- Avoid repeat cropping with the same species. This avoids the potential for pest and disease build-up.
- Consider crop rotation and weed control. Some crops and cropping conditions seem to encourage particular weed problems. These problems can occur in the current crop or in the next season's crop. It is important to note and record these weeds, particularly during the early planning stages, so that it is possible to plan their control when those conditions recur in the rotation.
- Precede soil-depleting crops with soil-replenishing crops. A rotation should generally consist of soil-depleting and soil-replenishing crops. Legumes can provide nitrogen for subsequent crops. Other crops, such as those with deep tap roots, have the ability to exploit a greater area of the soil nutritive reserve. Some crops are chosen on the basis of their ability to add to soil organic matter. With green manure crops, the aim should be to have a range of species that fulfil all of these requirements.

Spatial design considerations

Row and inter-row spacing, the number of crop rows per bed, and interplanting with other species to act as insectaries or trap crops are some of the spatial design considerations when planning a cropping phase.

Pests, diseases and weeds

Before planting, it is essential to carefully develop planting and crop rotation strategies in order to avoid or reduce the risk of losses resulting from pests, diseases or weeds.

The crop spacing and its relationship with other crops can influence the occurrence and dispersal of pests and their predators. Insectaries (to provide food sources and thus encourage beneficial predatory insects) and trap crops (to provide a preferred food source for the pest) are often

interplanted in strips or planted as a border surrounding the main crop.

Understanding a pest's ecology and dispersal characteristics will help when designing cropping layouts. For example, to limit the spread of aphid-transmitted virus, crops planted later can be planted upwind of fields planted earlier. In New Zealand beetle banks have been successfully used around crops to prevent pests moving into the crops. Some planting layouts can also confuse pests and thus reduce egg laying or dispersal.

If a crop is known to be susceptible, planting into a site that has a known pest or disease history should be avoided. Similarly, weedy areas near crops, which can act as reservoirs for disease-carrying pathogens and crop pests, should be managed or avoided. Other environmental factors, such as local climatic conditions, should be also considered; for example, a site a few kilometres inland may be at less risk of infection from fungal disease than one in a higher rainfall or more humid area.

Starting production with a relatively weed-free site is a distinct advantage. Sites that are heavily infested with problem weeds – particularly perennials such as couch grass, kikuyu and nut grass – should be avoided or the weed thoroughly controlled before planting. Some weeds are indicators of soil problems such as poor drainage or an imbalance of nutrients and can be brought under control over time by modifying the soil condition.

Weeds grow best where there is minimal competition – for example, where there are gaps in a crop stand. Because weeds are better competitors, they will occupy these sites rapidly. Several practices can reduce the potential for weeds to invade a site:

- decreasing the inter-row spacing – that is, increasing the crop sowing rate;
- decreasing the distance between rows or beds;
- increasing the number of crop rows on a bed;
- growing a competitive crop or a crop that is readily cultivated – for example, pumpkin and potatoes.

The aim is to close the crop canopy as quickly as possible. In the case of crops that never establish a competitive canopy – such as onions and, to a lesser extent, carrots – other strategies are needed. Increasing the sowing rate can affect the total yield and the size of the product – for example, the head size of cauliflowers and the bulb size of onions. Any strategy that changes crop or row spacing must be compatible with the available machinery and equipment.

Control of noxious weeds is a legal requirement. Local councils and state and territory agriculture departments can provide details of weeds that are declared noxious. Similarly, if a producer intends to grow vegetables in a fruit-fly exclusion zone, strategies must be developed for dealing with a possible fruit-fly outbreak.

Economics

When determining the economics of organic vegetable production it is necessary to take into account not only the profitability of growing the particular crop but also the profitability of the entire rotation.

When interpreting economic data, such as gross margins, several important points need to be taken into consideration.

- Data quoted should be adapted for the enterprise in question. For example, the yields obtained and management practices used are site specific, so data should be modified to reflect different management regimes and sites.
- Returns for produce will vary from season to season and will generally depend on supply at that particular time and in that particular market.
- Gross margin budgets are only an indication of potential costs and returns for an enterprise in any particular year. Factors such as climatic variability, management expertise and market fluctuations will vary the budget.

Soil and crop nutrition

Most vegetables prefer a well-drained loam or clay–loam soil with a pH of about 6.0 to 6.5. A thorough mapping of soils on the site should be done in order to determine if soil nutrition or the soil structure needs attention. Some adjustment will most probably be necessary before planting, in keeping with the crop's nutritional requirements. The soil should also be tested for pesticide residues and heavy metal contamination: unacceptable levels could exclude produce from organic certification or could exclude the growing of particular crops, such as root vegetables.

Compost is an essential nutritional input for an organic vegetable farm, so it would be an advantage to have access to a local source of compostable material. This could include animal manures and crop waste from other agricultural enterprises, but these materials would have to be free of excessive pesticide and heavy metal residues. Most certifiers prefer that on-site composting facilities be developed. An area of the farm should be set aside for compost production, well away from watercourses and dams to avoid pollution.

Water

A large, reliable water supply must be available, and it is essential to ensure access to it by confirming this with the relevant authority. The water should be tested to determine its suitability for irrigation; it should also be tested for chemical contamination, particularly if the source comes via an adjoining (non-organic) property – for example, from a creek, river or irrigation channel.

Proximity to non-organic neighbours

Although proximity to non-organic neighbours is not the deciding factor when choosing the site of an organic vegetable growing enterprise, it is important to determine the potential for chemical contamination from those neighbours. It is advisable that organic producers approach their neighbours and explain that they are organic growers and that they risk de-certification if chemical contamination of their produce occurs. The New South Wales *Pesticides Act 1999* offers some legal protection against pesticide contamination.

If there is potential for contamination, organic producers are required to incorporate non-certified buffer zones between the certified area and adjoining properties. Buffer zones can consist of windbreaks, wildlife and insectary corridors, or uncertified cropping areas. Properly selected and located, zones of vegetation add to the biodiversity on a farm and attract birds and other beneficial species that help to control pests.

Transport

Access to reliable transport is essential for moving fresh produce to market. The transport might need to be refrigerated if highly perishable crops are grown, and transport operators should be made aware that the produce is organic and that it must be isolated from conventional produce to minimise the risk of contamination.

Labour

Vegetable production is usually a labour-intensive enterprise – and particularly so for an organic vegetable enterprise. Some estimates suggest that one person can efficiently operate a 1 ha mixed organic vegetable enterprise. Access to additional labour should, however, be considered, especially during peak harvest periods and for any extensive hand-weeding operations. If on-farm value-adding is done, extra labour will almost certainly be needed.

Equipment

Many successful larger organic vegetable enterprises use a range of specialised equipment to help with farm operations. The equipment needed depends largely on individual situations. Most producers grow vegetables on raised beds (1.5 m centres are common), so tractors require high clearance and a wheel spacing that suits the bed size. An extensive range of farm equipment is available to market gardeners, though some of it – particularly equipment used in weed management – is expensive or hard to obtain in Australia. The good news, however, is that more is being imported or manufactured locally by entrepreneurial dealers and growers. Although it might be possible to modify existing equipment, some purchases should nevertheless be budgeted for. Among the specialist equipment currently in use in Australia are flame and steam weeders and brush weeders.

Some of the most useful tools for organic farmers are hand operated. Such tools often allow for greater flexibility and accuracy under a greater range of conditions. For larger vegetable enterprises, an excellent reading resource is *Steel in the Field: a farmer's guide to weed management tools* (Bowman 1997), which provides case studies of a number of organic vegetable producers and describes, among other things, their choice of equipment, the equipment's uses, its compatibility with other equipment, and the suppliers.

Monitoring performance

Record keeping is essential and is a requirement of certification compliance. Ideally, all growing beds should be numbered, and records should be kept of crops grown, weed, pest and disease incidence and control measures used, successes and failures, soil analysis results, green manures, fertilisers and other inputs applied, and weather data. Information should be recorded immediately after an operation is completed.

References

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ISSN 1832-6668

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Job number 8830