

## Gross Margins for Horticultural Crops in the NT - General Guidelines

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### INTRODUCTION

The aim of this Agnote is to provide general guidelines on the use of a gross margin (GM) as a planning and economic assessment tool for NT horticultural producers. Gross margins can be used to assess the profitability of alternative crops under various scenarios, such as different varieties, different growing methods, and/or technologies. They can also be used to plan the most optimum crop combination to maximise returns, prepare farm cash flow budgets, calculate costs of production of individual crops and to benchmark individual grower performance against the group average and group best practice.

It should be noted that the GM of a crop reflects the method of growing that crop, or its production system. Therefore, before working out a GM, a grower would need to decide on the techniques of growing a crop and the marketing system which he/she will adopt, as well as other factors such as using family or casual labour, or contractors for producing the crop. Labour inputs would be required for land preparation, planting, chemical spraying, pruning, picking, packing and marketing. Different production systems will involve different methods and therefore, costs and returns will differ. Advice from DPIFM extension officers/researchers, other growers and private consultants can be helpful.

### DEFINITION OF A GROSS MARGIN

A GM is the difference between gross income and variable costs. In other words, a Gross Margin = Gross Income - Variable Costs.

Gross margins are commonly calculated on a per hectare basis. They may also be expressed in other terms, such as per carton, per tray of produce, per labour unit, per ML of irrigation water, or per \$100 of capital invested.

#### Gross Income

Gross income is the yield per hectare multiplied by unit price received. Depending on where you are selling your produce, your selling price can be at the farm gate or at the wholesale markets or even at retail level, if you are selling directly to consumers.

To find current and historical fruit and vegetable prices, growers can contact market information consultants such as Brisbane's *Ausmarket Consultants* (Phone (07) 3379 4576, fax (07) 3379 4103); [www.austmarket.net.au](http://www.austmarket.net.au) (for interstate market prices) or the Australian Horticultural Statistics Handbook (for export and import prices) (Phone (02) 8295 2300).



## Variable Costs

Variable costs are those directly attributed to the enterprise. They vary in proportion to the size of the enterprise. Many variable inputs determine the yield or level of output of the enterprise. Little output would be achieved on farm unless money is spent on variable items. Conversely, although a large amount of money may be spent on meeting overhead costs, most of it has little effect on the level of crop yield because overhead costs are not related to a specific production activity.

For most horticultural crops, variable costs are made up mainly of:

### 1. Growing (or pre-harvest) Costs

They include:

**Land preparation.** Assuming that the land has been already cleared or cropped before, the cost of land preparation would usually consist of one round of ripping, two rounds of discing and one round of cultivating. The cost of machinery operations includes fuel, oil, repair and maintenance. Fuel costs depend on the size of the tractor and other implements. Fuel cost is calculated based on the tractor's power, measured in kWh or horse-power (1kW = 1.34 horse power). The average fuel consumption per kWh for a new tractor, ranges from 0.18 L to 0.32 L/kWh, depending on the engine's loading (% maximum power used). The cost of oil and lubricant is usually assumed at around 10% of fuel cost. Other costs such as regular repair and maintenance can be assumed at 2.5 – 3.0% of the value of new machinery/equipment per annum and can then be worked out for per hour of operation. A list of some common machinery and other input costs is given in Appendix 3.

**Other preparation and planting costs.** For annual crops, these include:

- Seed bed preparation.
- T-tape (for irrigation) laying and removing (including material and laying/removing cost).
- Plastic mulch (including plastic mulch materials and laying/removing cost).
- Seeds/seedlings.

This Section does not apply to **perennial crops** since the calculation of GM of perennial crops is based on mature trees only, not young or immature stands. The establishment cost (installation of irrigation system, site preparation, planting materials and the planting cost) is a part of the overall capital costs of a project and this should be treated as such in the whole farm cash flow budget analysis. For further information on cash flow budgeting for perennial crops, refer to DPIFM Agnote H 93, No. 780, "Guidelines for Budgeting for Orchards in the Northern Territory".

**Maintenance after planting.** This includes cost of fertiliser applications for both basal (basic fertilisers) and foliar (for micro-nutrients/trace elements to the plant) fertilisers. In general, soils in the Top End region are poor in nutrients, have low water holding capacity and are acidic. Fertiliser requirement varies depending on types of crop and types of soil. The NT Government provides a freight subsidy to commercial horticultural producers. The minimum claim limit per farm is 2 tonnes and the maximum is 300 tonnes. Check with DPIFM for the current subsidy rate. The receipts from the subsidy can be treated as an income. Refer to various DPIFM publications for guidelines on fertiliser applications for different horticultural crops.

**Weed control.** Includes both weedicide and tractor spraying cost. This can be by contractors or using own tractor and sprayers.

**Pest/insect control.** Includes both costs of pesticides/insecticides and spraying. This varies depending on the crop concerned. The spraying can be by contractor or by using own sprayers. The use of integrated pest management (IPM) can lower this cost through a lesser use of chemicals.

**Irrigation or water pumping costs.** Depending on location, soil types and water requirement, irrigation costs differ from one crop to another. Current irrigation costs (excluding capital and depreciation cost) for most mature fruit tree crops are in the range of \$350 - \$600/ha/year, depending on bore depth and the amount of water used. Irrigation costs for crops with a higher need for water, such as bananas and rambutans can be higher than these figures. Also, since most bores in the Alice Springs region are deep, irrigation costs in that region are expected to be higher than in the Top End. For annual crops, average irrigation cost per hectare in the Top End is estimated at around \$350/ha/ crop (around 3.5 ML is required per hectare at \$100/ML).

If the use of off-peak power is feasible, irrigation cost could be reduced since off-peak power rate is usually much lower than during peak hours. Producers who have to rely on diesel engines to operate pumps and other pumping equipment, may be eligible for the diesel fuel rebate. The current diesel fuel rebate rate for primary production is around \$0.39/L (as at March 2004). The application form can be obtained from the Australian Taxation Office, Diesel Fuel Rebate, phone 1300 657 162.

**Pruning/canopy shaping costs for fruit trees.** This can be casual labour or by contractors. The use of contractors for topping and hedging and casual labour for internal pruning appears to be the usual practice.

**Replacement costs for fruit trees.** Overall, the growing (or pre-harvest) cost is important. The various components of growing costs can determine the yield and quality of a horticultural crop. Without proper application of inputs, naturally, crop yield and quality will be affected. However, it has been shown that **in most horticultural crops, the cost of growing is not the major component, compared with other variable costs such as picking, packing and marketing.** For example, the growing cost for watermelon is around 18% - 20% of total variable costs. For mangoes, it is around 25% (Appendices 1 and 2). This emphasises the importance of the harvesting and marketing phase, especially the labour component during picking and packing. Also the cost of packing materials, transport and agents' fees are important to consider.

## **2. Picking and Packing**

The costs of picking and packing vary depending on the way the produce is harvested and marketed. At one extreme, mangoes can be pre-sold at the on-set of the fruit season to agents who will maintain, pick and market the produce themselves, which means there is no variable cost to the growers. At the other extreme, growers may themselves pick, pack and transport to southern markets or export to overseas markets. Some producers may even prefer to retail sell directly to the public. In the latter cases, growers would need to have all harvesting machinery/equipment and post-harvest handling and cool/cold storage facilities.

Labour costs for picking and packing can be estimated based on picking and packing rate per hour or per day. Allowance should also be made for labour requirements for odd jobs such as to supply picking crates, transport to sheds, dip preparation, de-stalking, de-sapping, labelling and other minor tasks. Other important costs associated with harvesting include post-harvest treatments such as de-greening (if required) and the cost of packaging materials - cartons, in-fills, sticky tapes and labels.

### 3. Marketing Costs

They include mainly transportation (by refrigerated trucks or dry trucks or by air) to southern markets and agents' fees. Current road freight rate by refrigerated trucks from Darwin to southern markets is around \$300 - \$350/tonne while air freight is around \$1.00/kg.

Most of the fruit and vegetables from the NT are sold at southern wholesale markets mainly in Sydney, Melbourne, Adelaide, Brisbane and Perth. Agents' fees usually average around 12.5% and range from 10% to 15% of the gross sale value.

Note:

- The owner's own labour is usually not included in GM analysis. However, when calculating production cost and in GM benchmarking, the grower's own labour and family labour should be valued at market wage rate to reflect the true cost of production.
- When comparing the gross margins for different crops, make sure they are calculated on the same basis. For perennial fruit tree crops, the GM is based on mature trees only.
- For simplicity, it is recommended that the GST exclusive approach (price/cost before the addition of GST) be used while working out GM.

### THE LIMITATIONS OF THE GROSS MARGIN

Note that GM **is not the same as farm profit**. GM does not take account of fixed or overhead costs such as permanent labour, bank interest, lease/rental fees and other fixed costs such as accounting, insurance, registration and administration. Overhead costs will be incurred regardless of the area of crop grown. Machinery and equipment must be assessed for suitability for growing similar crops. For comparative purposes, it is not useful to have gross margins of different crops, which need different types of machinery and equipment. For example, a certain set of machinery and equipment may be used for annual crops such as watermelons, pumpkins or zucchini. However, such machinery and equipment may not be suitable for use in fruit tree crops such as mangoes or rambutan. Care must also be taken when assessing the profitability of introducing new enterprises or changing the size of existing enterprises where additional capital or permanent labour is required. If substantial changes in capital or labour are required then other forms of budgeting need to be used (for example, partial budgeting and whole farm cash flow budget).

## THE USES OF GROSS MARGINS IN HORTICULTURE

- For budgeting and financial analysis:

Growers can find out the profitability of various alternative crops simply and quickly, using different assumptions on production techniques/growing methods. Sensitivity analyses can also be carried out to see how the gross margin changes based on various yield and price scenarios. Furthermore, by adding the fixed/overhead costs to variable costs, total whole farm budget can be derived so that more detailed budget analyses can be carried out using more sophisticated financial indicators such as internal rate of return, pay-back period and break-even analyses.

- For planning:

GM are useful in deciding on the best combination of crops/activities on a farm. The procedure here is to select the crop with the highest GM per unit of the most common limiting resource (such as land unit available, unit of ground water available, capital unit available, labour unit available) and expand it until some restraint is met. For example, rockmelon may show the highest GM, so it is selected and expanded until the area planted is such that reliable seasonal labour to harvest the crop may be a problem during that particular harvesting period. So another crop with a different harvest period is introduced and expanded until it too meets another restraint, and so on. This will result in the combination of the most profitable crops for optimum returns. Linear programming could be used for this type of exercise.

- For benchmarking:

By comparing your own GM with that of other growers in the same industry and/or in the same region, you can find out how your own performance compares with the group average and the group's best practice. This is known as "GM benchmarking". For example, the cost of a certain activity in the production chain in the same region (such as pruning or harvesting) can be compared between growers to work out the best practice. Similarly, yields of the same variety and the same region can be compared to find out the reason for yield differences between that of one orchard and the region's average or the region's best yield (best practice).

Examples of GM are given in the following two appendices. These are broad guidelines only. Individual growers should determine their own growing techniques and marketing strategies and work out their own GMs using the latest input and output prices and costs. Private consultants and DPIFM extension officers can provide further assistance.

**Appendix 1: GM - An annual crop - Watermelon, Katherine Region - Using drip tape and plastic mulch**  
Enterprise unit: 1 ha.

Item	Details	\$/ha	Notes
<b>A. INCOME:</b>	Yield: 25t/ha @ \$0.45/kg	11,250.00	
<b>B. VARIABLE COSTS</b>			
<b>B.1 GROWING COSTS:</b>			
COVER CROP	(Katherine pearl millet)		
Land preparation:			
Disc ploughing	1 round x 0.96 ha/hr @ \$14.93/hr	15.55	
Harrowing	1 round x 1.82 ha/hr @ \$8.47/hr	5.23	
Planting	1 round x 5.04 ha/hr @ \$9.70/hr	1.92	
Seed and fertiliser:			
Seed (Kath. pearl millet)	10kg/ha @ \$1.61/kg	16.10	
Fertiliser application	1x1.12 ha/hr @ \$9.70/hr	8.71	
urea	50 kg/ha @ \$0.55/kg	27.40	
Total Cover Crop Establishment		75.00	
<b>MAIN CROP</b>			
1. Establishment:			
Disc ploughing	2 x 0.96 ha/hr @ \$14.93/hr	31.55	
Cultivating/rotary hoeing	1 x 1.5 ha/hr @ \$12.50/hr	10.85	
2. Mulch and drip tape laying:			
Laying	0.29 ha/hr @ \$7.00/hr	24.14	
Plastic mulch	4400 m/ha @ \$0.16/m	704.00	
Drip tape	4400 m/ha @ \$0.20/m	880.00	
3. Planting			
Machinery cost	1 x 0.36 ha/hr @ \$6.94/hr	19.26	
Hybrid seeds	1 kg/ha @ \$485/kg	485.00	
4. Basal fertilising			
Tractor cost	3 x 0.88 ha/hr @ \$9.70/hr	33.00	
NPK 14:14:12	0.5 t/ha @ \$644.60/t	322.30	
Single super	0.5 t/ha @ \$405.80/t	202.90	
Side dressings:			
. urea	50 kg/ha @ \$610/t	30.42	
. Ammonium sulphate	0.13 t/ha @ \$544.60/t	68.08	
. Muriate of potash	50 kg/ha @ \$533.60/t	26.68	
5. Foliar sprays	(applied with insecticides)		
Sodium molybdate	3 x 0.50 kg/ha @ \$18.95/kg	28.43	
Magnesium sulphate	3 x 2 kg/ha @ \$0.67/kg	4.02	
Zinc sulphate hep.	3 x 2 kg/ha @ \$0.85/kg	5.10	
Boron	3 x 0.5 kg/ha @ \$2.69/kg	4.03	
Copper sulphate	3 x 1.0kg/ha @ \$1.89/kg	5.68	
Zinc sulphate	3 x 1.0 kg/ha @ \$0.85/kg	2.55	
6. Pest and disease control			
Spraying	2 x 0.48ha/hr @ \$7.99/hr	33.29	
Endosulfan	4 x 2.00 L/ha @ \$9.15/L	73.20	
Dipterex	4 x 1.00 L/ha @ \$30.64/L	122.56	
Ridomil MZ	1 x 2.50 kg/ha @ \$23.32/kg	58.30	
Bayleton 50 WP	2 x 1 kg/ha @ \$52.25/kg	104.50	
Rubigan	1 x 0.20 L/ha @ \$109.52/L	21.90	
Bavistin (or Spin)	1 x 0.50 L/ha @ \$12.00/L	6.00	
Wetting agent	4 x 2.5 L/ha @ \$4.66/L	46.58	
7. Irrigation			
application	3.5 ML/ ha @ \$90/ML	315.00	
Sodium hypochlorite	1 x 0.38 L/ha @ \$1.25/L	0.47	
8. Bee hire	1 hive/ha @ \$30/hive	30.00	
9. Harvesting			
Tractor costs	0. 4 ha/hr @ \$6.80/hr	16.99	
Casual labour (picking)	1.0 man hr/t @ \$12/hr or \$12/t	420.00	
10.Grading and packing			
Casual labour	0.5 man hr/t @ \$12/hr or \$6/t	210.00	
11. Packing materials	\$26/t (using 1 tonne bin)	910.00	
12. Marketing costs			
Freight (road)	\$130/t	4,550.00	
Commission	(12% of sale)	1,680.00	
13. Drip tape removal			
Machinery cost	1 ha/hr @ \$10/hr	10.00	
Labour	0.25 ha/hr @ \$12/hr	48.00	
14. Contingencies		383.29	
<b>B. Variable costs per ha</b>		<b>9,932.61</b>	
<b>Gross Margin per ha (A-B)</b>		<b>1,317.39</b>	

Source: DPIF Technical Bulletin 237: GMs of Major Cucurbit Crops in Katherine (May 1995)

**Sensitivity Analysis - Gross margins of watermelons (\$/ha) at various yields and prices (with plastic mulch)**

Yield (t/ha)	Southern market wholesale prices					
	\$0.25/kg	\$0.35/kg	\$0.45/kg	\$0.55/kg	\$0.65/kg	\$0.70/kg
15	-3,543	-2,223	-903	417	1,737	2,397
20	-3,313	-1,553	207	1,967	3,727	4,607
25	-3,084	-883	<b>1,317</b>	3,517	5,717	6,817
30	-2,853	-213	2,427	5,067	7,707	9,027
35	-2,623	457	3,537	6,617	9,697	11,237

## Appendix 2: GM of a perennial fruit tree crop - Kensington Pride mango, Darwin Region (mature orchard)

(Adapted from DPIFM Tech Bulletin No. 301 *Mango Profitability in the NT Top End*).

Unit: 1 ha, 200 trees/ha, mature trees (>10 years old) Date: April 2001

Item	Details	\$/ha	\$/tray
<b>A. Gross Income</b>			
Production (trays/ha)	7.25 trays/tree; 1450 trays/ha x \$20/tray		
Price (inclusive of freight and agent's fee)	wholesale market price @ \$20/tray		20.00
<b>Sale Income</b>		<b>29,000</b>	<b>20.00</b>
<b>B. Variable Costs</b>			
<b>B.1. Growing (pre-harvest) costs</b>			
Fertilisers			
- materials	for details, refer to Table 1	1,697	1.17
- application – machinery (1)	Operating cost of tractor/fertiliser spreader six times 1.5hrs/ha@\$558/hr	67	0.05
- Application - labour	1.5 hrs/round x 6 rounds/yr @ \$12/hr	144	0.10
Weed Control			
- materials	For details, refer to Table 1	122	0.08
- Application – machinery (1)	2hrs/ha x 3 times/yr x \$9.20/hr	55	0.04
- application - labour	2hr/round x 6 rounds/yr @ \$12/h	96	0.07
Insect/Disease control			
- materials	For details, refer to Table 1	308	0.21
- application - machinery	1hr/ha x 8 rounds/yr x \$9.20/hr	74	0.05
- application -labour	8 rounds x 1 hr/ha @ \$12/hr	96	0.07
Cultar application/cincturing (allow)		500	0.34
Slashing			
- by contractors	3 rounds x 1hr/ha \$40/hr	120	0.08
Topping/pruning			
- topping/hedging (contractors)	0.5hr/ha @ \$150/hr	75	0.05
- internal pruning	30 hrs/ha @ \$12/hr	360	0.25
irrigation (power)	7.5 HP pump	258	0.18
Repair and maintenance (1) (pump and irrigation system)			
		350	0.24
Other costs (12% growing costs)		519	0.36
<b>Growing (pre-harvest) costs</b>		<b>4,840</b>	<b>3.34</b>
<b>B.2. Picking and packing</b>			
cherry picker	Operating cost	176	0.12
picking - casual labour	9 trays/hr @ \$12/hr	1,933	1.33
de-stalking and packing:			
- casual labour	9 trays/hr @ \$12/hr	1,933	1.33
-boxes/infills/tapes/labels	@\$1.98 ea.	2,871	1.98
post-harvest treatment/dip:	Estimate	30	0.02
power (packing, cold storage)	Estimate	400	0.28
<b>Picking and packing costs</b>		<b>7,344</b>	<b>5.06</b>
<b>B. 3. Marketing Costs</b>			
freight	1,450 cartons/ha x7kg@ \$0.32/kg	3,248	2.24
agents' fees	12% gross sale value	3,480	2.40
other (levy)			
<b>Marketing Costs</b>		<b>6,728</b>	<b>4.64</b>
<b>B. Total Variable Costs (B1+B2+B3)</b>		<b>18,912</b>	<b>13.04</b>
<b>Gross Margin (A-B)</b>		<b>10,088</b>	<b>6.96</b>

(1) fuel, oils, repair and maintenance.

**Sensitivity Analysis – GM (\$/ha) of Kensington Pride mango at various yields and prices** Assuming: 200 trees/ha, over 10 years old trees, Darwin Region

	<b>5 trays/tree (7t/ha)</b>	<b>7.25 trays/tree (10.15t/ha)</b>	<b>10 trays/tree (14t/ha)</b>	<b>15 trays/tree (21t/ha)</b>
\$12/tray	-1,773	-120	1,900	5,574
\$15/tray	867	3,708	7,180	13,494
\$18/tray	3,507	7,536	12,460	21,414
\$20/tray	5,267	10,088	15,980	26,694
\$24/tray	9,667	16,468	24,780	39,894

### Appendix 3: Input prices

Machinery costs – Assuming a tractor - 2 wheel drive 90 HP, diesel fuel price (net of fuel excise rebate and GST claim): \$0.55/L.

	<u>\$/ha</u>
Ripping	11.22
Rotary hoeing	14.59
Discing	17.17
Bed forming and mulching	9.20
Slashing	11.22
Planting	7.98
Fertiliser application	5.58
Spraying	9.20

**Fertilisers:** Retail prices, bulk buy (as of March 2001, Darwin )

	<u>\$/tonne</u>
Nitrophoska blue	915.80
Urea	699.00
Single superphosphate	452.00
Triple super	738.80
DAP	855.00
Dolomite	341.50
Zinc (foliar)	216.48 per 25 kg
Crop king (11:12:12)	765.80
Potassium nitrate	1168.60
Ferrous sulphate	668.40
Zinc sulphate monohydrate	825.80

Source: Barnyard Trading, Darwin

**Prices of chemicals** (as of March 2001, Darwin)

Roundup CT	133.65/20 L
Gramoxone	257.46/20 L
Benlate	94.57/ kg
Agral	151.36/20 L
Rogor	185.00/20 L
Carbaryl	282.00/20 L
Summer oil	61.18/20 L
Chlopyrafos	350.20/20 L
Mirant	13.75/tube (175g)
Nemacur	967.78/20 L
Solubor	119/25 kg

Source: Barnyard Trading, Darwin

Up to date prices can be obtained from your local suppliers such as Barnyard Trading, Tropigro etc.

**Seed/planting materials:**

<u>Types of seed</u>	<u>\$/ha</u>
Butternut pumpkin	105
Mango – grafted	12
Jaradale pumpkin	70
Rockmelon (1kg/ha@ \$1,150/kg)	1,150
Squash (button)	359
Watermelon	558
Zucchini	334
Cucumber	483

Source: S & G Seeds, Victoria

**Freight costs:**

	<b>Refrigerated (\$/tonne)</b>
Sydney/Melbourne	\$320/t + GST (growers can claim back GST)
Adelaide	\$225/t + GST (growers can claim back GST)

**Casual labour:**

Picking/packing	\$10 to \$12/hr
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**Table 1.** Physical input assumed per hectare for mango orchard (>10 yrs old), Darwin

<b>Inputs</b>	<b>Units required per ha per year</b>	<b>Unit price</b>	<b>Costs per hectare</b>
<b>Fertilisers</b>			
Super phosphate (plus Cu, Zn)	Up to 7.6 kg/tree/yr	\$452/t	687
Agricultural lime	0.25 kg/tree every 2 yrs	\$341.50/t	34
Gypsum	1t/ha/yr	\$370/t	370
Crop king (12:12:12)	To 1.9 kg/tree	765.8/t	172
Potassium nitrate	25 g/tree, 3 times/yr	\$1.17/kg	123
Ferrous sulphate	4 g/L 7L/tree 4 times/yr	\$0.67/L	194
Foliar zinc	2 g/tree , 4 times/yr	\$8.66	117
<b>Weed control</b>			
- Round up	2 L/ha, 1 time/yr	\$6.68/L	13
- Gramoxone	1 L/ha, 2 times/yr	\$12.87/L	26
- Agral (wetting agent)	0.07 L/ha , 3 times/yr	\$7.57/L	2
<b>Pest/Insect Control</b>			
- Rogor	1 L/ha, 4 times/yr	\$9.25/L	37
- Summer oil	7.50 L/ha, 5 times/yr	\$3.05/L	114
- Cabaryl	1.50 L/ha, 5 times/yr	\$14.10/L	69
- Mirant	6 tubes/ha	\$13.75 ea.	83
- Agral (wetting agent)	0.1 L/ha, 6 times/yr	\$7.57/L	5

Note: The use of trade names in this Agnote is for costing purposes only. It does not imply any endorsement of any particular product by DPIFM.

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