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land series

Erosion control for bananas

Soil erosion can be a major problem in the production of bananas on steep slopes and undulating areas in the coastal areas of Queensland. The continual loss of topsoil and plant nutrients (including fertiliser) reduces yields as well as fruit size and may have an adverse impact on downstream water quality. Washouts lead to rough access tracks that are responsible for damaging fruit and slowing down the harvest.

If erosion control strategies are implemented at planting time, the above problems can be greatly minimised or avoided. To be successful, erosion control must include both the control of runoff and the maintenance of ground cover.

Causes of erosion

- Bare soil is more susceptible to soil erosion than soil with a cover such as living or dead plant material.
- High-intensity rainfall associated with storms, cyclones and monsoonal rains, generates a large volume of runoff. If this runoff is uncontrolled, it will produce serious soil erosion particularly in freshly cultivated loose soil.
- Inappropriate row direction, for example, up and down slopes greater than 3% and lack of runoff control structures can result in serious soil erosion.
- High rates of runoff and serious erosion can occur on shallow soils, soils with low water infiltration rates or impervious subsoils.

Choosing suitable land

Bananas can be grown on a range of soils provided there is good drainage, adequate fertility and moisture. Land slope should not exceed 15% for plantations with single row mounds across the slope. If double row mounds are to be used across the slope, the land slope should not exceed 6%.

Runoff control structures

Runoff control on sloping banana land can be achieved by a properly designed contour system. Such systems are compatible with most aspects of banana crop management. They provide erosion control by slowing the runoff water enough to prevent scouring but not enough to prevent good drainage.

There are four main parts to a contour system in bananas: diversion banks, contour mounds, grassed waterways and access roads. Figure 1 shows how these structures fit into a typical contour layout on a banana plantation.

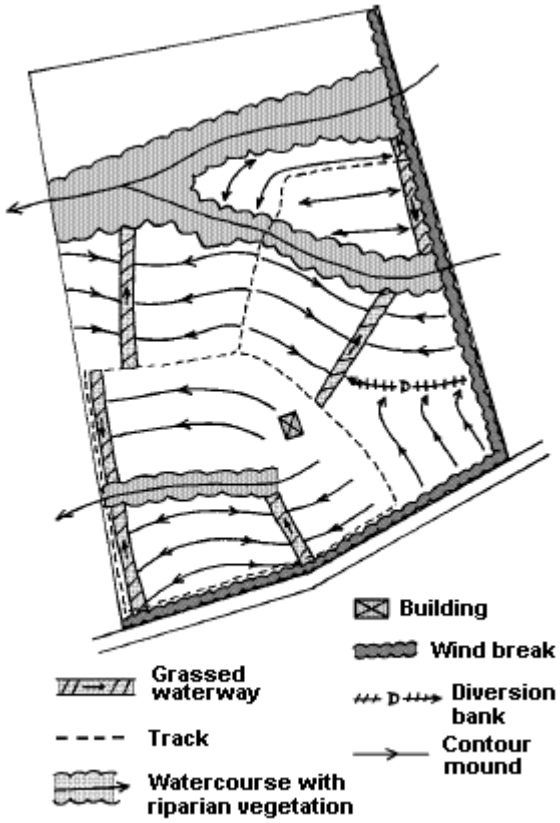

Fig 1 Runoff control plan for a banana plantation

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Diversion banks

Diversion banks prevent runoff flows entering from outside the banana block.

Often it is necessary to construct a diversion bank directly above the plantation to divert excess runoff into a stable watercourse or grassed waterway. It needs to be constructed prior to establishment of the plantation.

Contour mounds

Contour mounds are constructed to carry runoff across the slope at a slow speed to decrease erosion (Figure 2). The bananas are planted on top of the mounds and runoff is carried by the channels between them.

Fig 2 Mounds on steep land ready for planting

Layout

Contour layouts are kept parallel by varying the gradients of the mounds between a set minimum and maximum. For most soil types the minimum gradient is 1% and the maximum is 3% but this can be increased to 4% for Krasnozem soils. Occasionally on uneven country the row gradients may become too flat or too steep and then a correction bay containing some short rows becomes necessary.

To achieve the best soil conservation layout some land preparation may be necessary before marking it out. Any hills and hollows such as old wash lines that will not be used for waterways should be filled in and levelled. This allows more even curves in the mounds with less likelihood of them overtopping.

Construction

Contour mounds should be built to a height of 30 cm using a grader, Vee drainer or ditcher. The minimum height after settlement should be 20 cm.

Contour mounds are normally spaced at a distance of 4.5 to 6.5 metres depending on width of machinery and whether the bananas are grown in single or double rows.

On land slopes under 6%, the mounds can be made wide enough for double rows (Figure 3). On steeper land it is best to plant a single row on each mound because it is difficult to build structures which have adequate capacity (Figure 4).

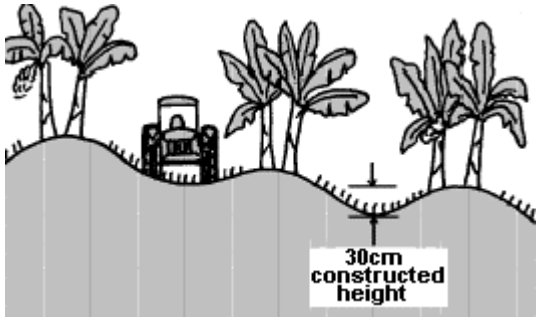

Fig 3 Contour mounds – double rows

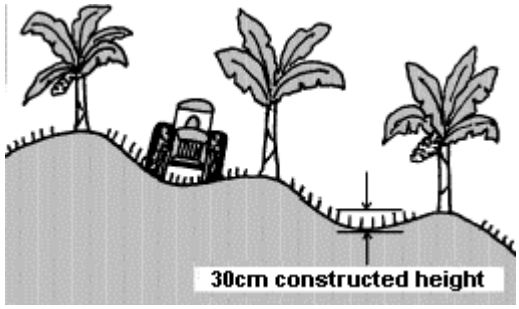

Fig 4 Contour mounds – single rows

Care is required on steeper land that the mounds do not end up looking like terraces (Figure 5). These are not recommended. As well as lacking capacity, the terrace-like mounds may have unstable steep batters and the shape may cause management problems. For example, difficulty in reaching bunches when picking, and problems destroying the old stool when ploughing out.

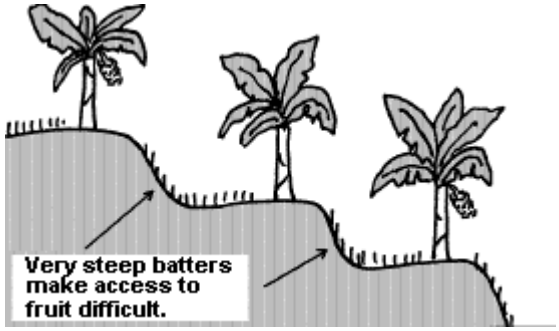

Fig 5 Terrace like mounds are not recommended

Grassed waterways

Grassed waterways are either natural grassed depressions or constructed shallow grassed drains which receive runoff water from the other structures. Water runs down the waterway to a watercourse.

Construction

Waterways are best constructed with a scraper or scoop. It is important that the rows are able to drain freely into the waterway. This means that the

waterway must be deeper than the channels draining into them. Excess soil should be cleaned out of the ends of inter-row drains following construction of the waterway.

Stabilisation

Grassing of waterways can be difficult. This can be due to lack of rain preventing seed germination or too much rain causing washouts of recent grass plantings. It may be necessary to irrigate until the grass is established. Creeping grasses such as carpet grass (*Axonopus compressus*) or signal grass (*Brachiaria decumbens*) are most suitable. A quick growing annual such as Japanese millet may be used to give temporary cover until the grass establishes.

Hydromulching, which involves spraying a mixture of seed, fertiliser and stabiliser onto the surface of the waterway can be very effective although the cost is relatively high. Hydromulching would probably only be used when other methods have not worked.

Maintenance

Grass in waterways should be kept short to ensure adequate runoff flow. Desilting should be done as necessary to maintain waterway capacity. Major repairs to waterways should generally be left until after the wet season to allow time for grass to regrow.

Access roads

Good access roads minimise bruising of fruit by providing a smooth passage for fruit to the packing shed.

To avoid erosion of access roads they need to be located in positions where they will not collect runoff. The best locations are ridge lines and on the contour. These locations will ensure that access roads do not divert water into the plantation.

The channels between the mounds are used to gain access from the roads to the individual banana plants. A wider spacing may be necessary between some mounds to provide space for the picking trailer used during the harvest.

For more information on road construction refer to the DPI *Agrilink Tropical Banana Information Kit.*

Ground cover

Ground cover provides protection from erosion by lessening the impact of rainfall droplets and slowing the movement of runoff water. Following planting, grass and other weeds growing in the channels between the mounds should not be cultivated or sprayed. An occasional slashing is recommended.

Fig 6 Good inter-row cover extending under the canopy dripline

Weed control should be restricted to the tops of the mounds between the banana plants. When the crop canopy is fully developed, shading will restrict weed growth. If harvested pseudostem material is left in the channels it should be chopped up so that it breaks down quickly and does not impede runoff flow.

Various plant species including Pinto's peanut (*Arachis pintoi*) are commonly used as ground covers in organic banana plantations. While providing effective erosion control, yield reductions may occur if Pinto's peanut is not kept clear of the banana stool.

If ground covers and trash are not kept away from the base of stools, then it may encourage populations of banana weevil borer as well as affecting insecticide and nematicide applications aimed at the plant corm and surrounding soil.

Annual maintenance

It is a good idea to implement an annual maintenance program to ensure that the soil conservation layout is in good condition prior to each wet season.

Immediately after the wet season is the best time to carry out major repairs to waterways. This allows time for the grass cover to establish in any disturbed area. The pre-wet season check should cover these main points:

- Diversion banks are sound and of correct height
- Mounds have not been damaged by machinery or animals. The mounds need to have a settled height of not less than 20 cm.
- Outlets of channels between mounds are free of obstructions to ensure good outflows of runoff water.

Windbreaks

In exposed areas banana plants need protection from strong winds. Windbreaks give protection from the prevailing south-east winds and help reduce damage from strong winds associated with storms and tropical cyclones. They reduce leaf tearing and transpiration which in turn reduces the plantation's water requirements.

At least 10 metres should be left between the windbreak and the first row of plants to allow machinery access and to reduce the competition for water and nutrients.

Benefits of a good banana layout

1. Higher yields due to reduced losses of soil and plant nutrients including fertiliser.
2. Less maintenance of roadways and inter-row passageways required.
3. Essential machinery operations for various aspects of crop management are less restricted following heavy rain because of better access.
4. Minimised postharvest bruising in transit to the packing shed because of better access roads.
5. More efficient use of irrigation systems due to more even pressure distribution along contoured banana rows.
6. More efficient use of available water, particularly during drier periods.
7. Improved drainage of wet areas.
8. Reduction in chemical and sediment pollution of rivers and streams.

Further information

Further information is available in the *Agrilink Tropical Banana Information Kit* which can be purchased by calling the DPI Call Centre at 13 25 23. The *Self-help Landcare for New Farmers* book issued by the Department of Natural Resources and Mines also provides useful information related to this topic. It can be obtained by contacting the NR&M Service Centre, Locked Bag 40, Coorparoo Delivery Centre, Q4151, telephone 3896 3216.

Soil acidification is a significant problem in the banana industry. For more information see *NRM Facts* L45 *Soil acidification*. ■