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Turfgrass mat as quick slope cover and landscape productivity enhancement

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Introduction

The tropical turfgrass, *Axonopus compressus* (cowgrass) is a common ground cover plant in Singapore's horticultural landscape. Its wide utility includes: (1) slope turfing; (2) roadside turf; (3) recreational/amenity turf e.g., lawns in parks, homes and green roofs as well as (4) sports turf in school fields and stadium.

The major nursery production method of cowgrass plants for landscaping in Singapore is by vegetative stolons (horizontal growing stems). Stoloniferous turfgrasses lack the ability to form a tight turf sod (a piece of earth joined by grasses and roots) due to the absence of an underground horizontal rhizome system to bind the soil particles. Therefore, the establishment of cowgrass turf is by close turfing of cowgrass plugs in Singapore. A cowgrass plug is defined as a chunk of earth (usually 50 mm thick) with cowgrass plants (**Fig. 1**). The close turfing of cowgrass plugs entails three basic steps: (1) spreading of cowgrass plugs directly onto the soil base of clay or sand, **Fig. 2 – 4**; (2) light compacting of cowgrass plugs onto the soil base using a garden hoe and (3) irrigating of the cowgrass plugs after compacting (**Fig. 5**).

Fig. 1 Typical cowgrass plug planted with heavy clay soil

Fig. 2 A heap of cowgrass plugs on construction site for close turfing establishment

Fig. 3 Workers performing close turfing of cowgrass plugs on bare soil surface

Fig. 4 Bare soil surface covered by cowgrass plugs (close-turfing method)

The success and rate of cowgrass plants establishment for the close turfing method are dependent on (1) the spacing between plugs and (2) relative water content within the clay soil of the plugs to facilitate the growth of roots (within the plug) into the soil beneath (**Fig. 6**). The finished turf surface established using this method is uneven as the cowgrass plugs are irregular in shape and thickness (**Fig. 7**). An additional step of soil-topdressing and machine rolling are needed to obtain an even turf surface. However, both the light compacting and machine rolling are harsh procedures for cohesive soils as these will result in undesirable soil compaction effects such as lowered infiltration rate.

This Research Technical Note (RTN) reports and proposes a basic prototype for an alternative method of establishment of cowgrass on an erosion control mat. This method of establishment could bring potential benefits to improve labour productivity in landscape turfing. In addition, a ready cover of cowgrass plants can be achieved in a shorter time compared to conventional close turfing. This is especially beneficial to turfing on slopes as an instant green cover can be achieved in a relatively safer and shorter period of time (**Fig. 8**).

Fig. 5 An aerial view showing closely turfed surface using cowgrass plants. Irrigation of the completed turf surface is performed manually by garden hose

Fig. 6 Drying of cowgrass plugs result in loss of density and rate of establishment by cowgrass plants

Fig. 7 The undulating surface is a result of patching bare spots with irregular shape and height of cowgrass plugs

Fig. 8 Close-turfing of slope performed by several workers over many hours

Methodology in establishing *Axonopus compressus* (cowgrass) on erosion control mat (Prototype demonstration)

1. A piece of erosion control mat (ECM) made of machine-weaved coconut fibres and plastic netting is laid on a plastic tray, **Fig. 9A**, over a plastic bag (**Fig. 9B**), or on plastic sheet (**Fig. 9C**) without drainage holes
2. A thin layer of compost (20 mm) is spread on the ECM, **Fig. 9D**
3. Several cowgrass plants are randomly planted on the compost layer, **Fig. 9C**
4. The compost layer is kept moist throughout the establishment phase
5. Granular fertilizers are applied lightly to promote growth
6. The cowgrass mat with dense healthy roots, can be lifted from the plastic tray/bag/sheet when desired coverage is obtained, **Fig. 9F – H**

Fig. 9A A piece of erosion control mat placed in the plastic tray

Fig. 9B A piece of erosion control mat placed over a plastic bag

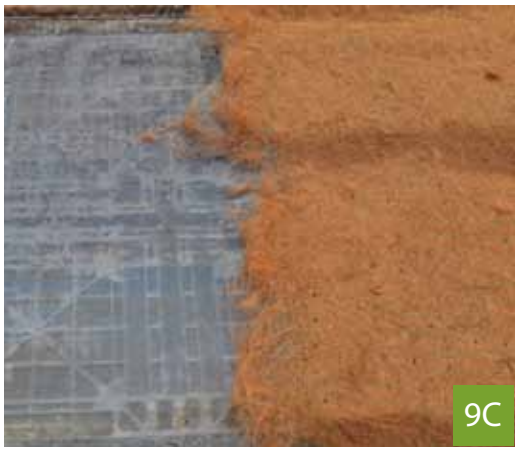

Fig. 9C Erosion control mat placed on a thick plastic sheet

Fig. 9D Thin layer of compost spread on the erosion control mat

Fig. 9E Cowgrass plants were planted on compost layer

Fig. 9F Cowgrass plants spread horizontally on compost layer in 4 weeks

Fig. 9G Profuse lateral coverage of cowgrass plants was obtained over the erosion control mat

Fig. 9H Dense, healthy roots on the underside of erosion control mat

Comparative turf coverage between cowgrass mat and cowgrass plug

The total turf coverage between cowgrass plug and cowgrass mat was determined by measuring the total green coverage over 4 weeks. Similar irrigation frequency and fertilizer regime were applied to both treatments (cowgrass plug and mat) to evaluate the turf coverage. Findings from the comparative coverage study are summarized in Figure 10 below:

Fig. 10A Clay soil base marked for experimental planting

Fig. 10B The underside of a cow grass plug, showing clay soil with roots

Fig. 10C The underside of a cowgrass mat showing mat of roots

Fig. 10D Piece of cowgrass plug on clay soil base on day of planting (Coverage = 274.64 cm^2)

Fig. 10E Piece of cowgrass mat on clay soil base on day of planting (Coverage = 508.12 cm^2)

Fig. 10F Cowgrass plug showed signs of drying after one week of planting. This resulted in a decrease of turf coverage by 30%
(Coverage = 191.14cm^2)

Fig. 10G Cowgrass mat increased in turf coverage by 10% after one week of planting. The increase in coverage was contributed by an increased horizontal growth
(Coverage = 562.39 cm^2)

Fig. 10H Cowgrass plug had an overall increase of 390% coverage after 4 weeks of planting. More vertical growth than horizontal growth was demonstrated
(Coverage = 1354.65 cm^2)

Fig. 10I Cowgrass mat had an overall increase of 500% coverage after 4 weeks of planting. Extensive lateral growth was demonstrated
(Coverage = 3092.19 cm^2)

Fig. 10J Uneven turf surface from cowgrass plug. Additional weight was required to balance the spirit leveler

Fig. 10K Relatively flat and even turf surface from cowgrass mat. No additional weight was required to balance the spirit leveler

Fig. 10L Average vertical height of cowgrass plants was 15 cm

Fig. 10M Average vertical height of cowgrass mat was 10 cm

In summary, the cowgrass plants could be established effectively on an erosion control mat over plastic covers (tray/bag/sheet). The total turf coverage established from a mat of cowgrass plants was 110% higher than a plug of cowgrass. However, this finding has to be better evaluated as data was collected from a single prototype established from this study. Nonetheless, the apparent higher coverage by the cowgrass mat can be postulated to be a result of better roots and soil contact in comparison to the cowgrass plug. The least resistance pathway taken by the massive system of root in the mat could have assisted the plants to establish themselves quicker. However, it is unclear why the cowgrass plants established on the mat continued to spread laterally rather than vertically when transferred to the clay soil base, given that the constraint of root zone volume was removed. Nevertheless, the increased lateral growth over vertical growth is a desirable characteristic for turfgrass establishment.

Further studies will be conducted to (1) scale up the prototype of cowgrass mat, including the estimated cost in production; (2) examine the biological significance behind the putative increase in lateral growth by cowgrass mat when they are removed from a constraint root zone environment.