DESIGN, DEVELOPMENT AND TESTING OF TWO WHEEL TRACTOR COUPLED DRAINAGE CHANNEL DIGGER

H.F. Ahamed, G.V.T.V. Weerasooriya, P.D. Kahandage
Dept. of Agricultural Systems, Faculty of Agriculture, Rajarata University of Sri Lank
Puliyankulama, Anuradhapura.

Field crop cultivation plays a major role in Sri Lankan agriculture sector. The crop g considered as other field crops in Sri Lanka consists of coarse grains; maize, finger millet condiments; chili, onion, *etc.*, grain legumes; mung bean, black gram, cowpea, soybean, and oil crops; sesame, groundnut, sunflower, *etc.* Upland flat areas, slopy areas and paddy fi during off season are mostly being used in field crop cultivation. Around 580,000 fa families are engaged in other field crop cultivation and the contribution to the GDP is 1.7% agricultural lands the drainage system is important for diverting the excess water from the as well as for supplying more water for the place where it suffers from water scarcity. The w drainage refers to removal of water in excess of the quantity required for growth development of crop by artificial means[2]. The soil fertility can be improved by protecting soil from soil erosion through the drainage system.

Drainage channels reduce soil erosion in slopy areas, removes the salt accumulation in the fi and manages water supply[3]. There are many types of drainage channels available in the c field. Drainage systems can fall into one of several categories, depending on the topography geology of the land as dendritic drainage system, parallel drainage system, trellis drain system, rectangular drainage system, radial drainage system, deranged drainage system, annular drainage pattern. The construction of field drainage channels manually, us mamoties, which is presently practiced method by farmers, is highly inefficient and drudgery field operation before planting. Even though some ploughs and ridgers are used for construction of field drainage channels they do not provide the sharp, deep and vertical cut the drainage channel as they are not designed for this purpose. The unavailability of a spec farm equipment for drainage channel construction, farmers are forced to neglect this fi operation especially the large scale farmers, which leads to poor drainage conditions in fields. Hence the aim of this study was to design develop and evaluation of drainage chan digger by utilizing readily available farm power source; two wheel tractor.

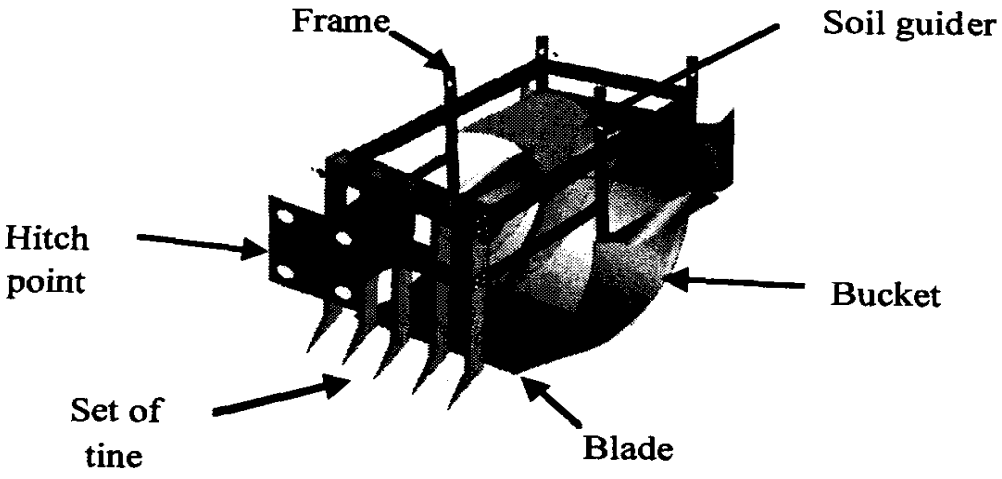

Figure 01: Major Components of Prototype

As shown in Figure 01, the main components of this digger were a set of tines, blade, bucket, s guider, frame and hitch attachment. All the parts were made using flat

and "L" iron bars and connected with permanent and non permanent fastening methods. The digging depth of the tines, bucket angle and depth could be adjusted. The fabricated prototypes were tested for its performance and modified by using the classic approach of farm machinery design and development. Each prototype was provided with more strength and information to develop the final prototype and was tested for field performance.

In prototype testing, following defects were identified and required modifications were made. Depth of the drainage channel was not adequate:- for this the depth of the tines, the angle and depth of the bucket were adjusted and two extra cutting points were attached to the cutting edge of the blade. Weeds and traces were entrapped due to close spacing between tines:- the number of tines was reduced. When loading the digger, it tended to bend, break and showed unbalance condition due to the low strength and weight of the equipment:- the frame of the equipment was strengthened. Soil was encumbered on the Bucket due to the improper function of the soil guider:- the soil guider was modified. Finally, a furrow wheel was fixed to achieve straight drainage channels. After all the modifications, the final prototype was fabricated and tested for its field performance in un-ploughed land (T_1), land with primary tillage (T_2) and land with both primary and secondary tillage (T_3). Table 01 shows the field conditions of test fields.

Table 01: Test field condition

Treatments	Average		
	Penetro Meter Reading for 500 N (cm)	Bulk Density (g/cm^3)	Moisture Content by Dry Basis (%)
T1	2	1.848	9.926
T2	13.3	1.795	9.611
T3	15	1.745	6.173

The digger showed significantly higher field performance in primary and secondary tilled soil (T3). The achievable depth of channels was 8 - 12 cm. The digging capacity was 188.679 m/hr. Field efficiency 67.8%. The cost and time saving compared to the manual method was 78.74 % and 85.24 %, respectively. Therefore, the developed two wheel tractor- coupled drainage channel digger could be recommended as a good solution for the drainage construction problem in upland fields. To get the maximum output of the digger, the two-wheel tractor should be manipulated in low gear ratios and the strength and the weight of the machine should be increased. The digger should be well cleaned and lubricated after use, to avoid unnecessary rusting and to expand the shelf life.

Key Words: Drainage, drainage channel, field testing, test field conditions, field crops

REFERENCES

1. Malawiarachchi, M.A.P.W.K., Nijamudeen, M.S., Senanayake, D.M.J.B., Perera, R.A.C.J., Amarasinghe, L. (2009). *Climate Change and Other Field Crop Production in the Dry Zone of Sri Lanka*, Field Crops Research & Development Institute, Maha illuppallama, Sri Lanka. Retrieved May 08, 2012, from www.cdmstudycentre.org
2. Lenka.D (2005). *Irrigation and Drainage* (3rd ed). Kalyani Publishers. New Delhi. 221 pp
3. Onuchukwu O. (2008) *Drainage system and its importance*, Retrieved April 28, 2012, from http://ezinearticles.com/?Drainage-Syatem-And-Its-Importance&id=1025782