CHAPTER I

INTRODUCTION

The crucial role that dryland agriculture plays in India's economy is now well recognized. Out of the 143 million hectares of cultivable land in India, about 108 million hectares fall under rainfed agriculture from which about 42 per cent of the total food grains and 75 per cent of the pulses and oil seeds are produced in the country (11).

The thrust of agricultural development has so far been concentrated on irrigated areas which are capable of giving assured and quick response. As a result, the conditions of the farmers in the irrigated areas have considerably improved. On the other hand, the majority of the farmers in the rainfed areas are still practicing subsistence farming andstruggling below the poverty line. The production in drylands is closely linked with fluctuating weather conditions, and intensity and timely distribution of rainfall. In order to develop the dryland farming system, the Government of India has initiated many research schemes in different parts of the country and concentrated efforts are being made in this regard.

1.1 Problems Associated with Dryland Farming

In drylands, the farmers mostly use bullock and human power to carry out various agricultural operations. The average power available for these lands is nearly 0.22 hp/ha (11) as against 0.5 hp/ha on irrigated areas (56). This appears to be

very low in view of the heavy demands of power in short periods of time to complete critical farm operations which mostly depend upon rainfall.

As 86.5 per cent holdings in India are less than 5 hectare in size covering 48.2 per cent of the total cultivated area, the farmers under this category utilize mainly bullock and human power for farm operations. All India Co-ordinated Research Project for Dryland Agriculture, Hyderabad, Andhra Pradesh, India with the help of their 23 co-operating centres has assessed that tillage is one of the most important operations in dryland farming for enhancing the crop yield. It consumes about 30 per cent of the total energy utilized for crop production (1).

Tillage is considered to be essential as it brings desirable changes in physical, biological and chemical nature of soil which promote seed germination and plant growth. It helps in moisture conservation leading to extension of seeding date and plays a vital role in boosting the crop yield. The important implements that are used for tillage operations in dryland areas are cultivator with sweep or tine, mouldboard plough, country plough, sub-soiler and blade harrow. Out of these, the blade harrow commonly known as Bakhar blade or Guntaka is adopted by the majority of the farmers in the country.

1.2 Animal Drawn Blade Harrow and Its Use

The blade harrow is one of the most important and widely used tillage implements in drylands or semi-arid regions of

India. It is especially used in black and medium black soil tracts of Gujrat, Madhya Pradesh, Rajasthan, Maharastra, Andhra Pradesh, Karnataka and Tamilnadu (50). The farmers use it to supplement the work of a plough for preparing the seed-beds and for covering the seeds after sowing. This implement is also used for eradication of weeds, which it does by cutting the stems of the weeds below the ground. It is an effective implement for intercultural operations and also used for creating soil mulch after rains in order to conserve the soil moisture. Depending upon the region and crop row spacing, the length of the bakhar blade varies from 20 cm to 152 cm ; width or depth from 6 to 10 cm and thickness from 0.6 to 1.2 cm (20). It can cultivate the land upto a depth of 9 to 10 cm and can cover 0.8 to 1.6 ha.in a day because of its greater length.

The popularity of this implement is due to its simpler design and low constructional cost. It's low power requirements enable it to be pulled by a pair of medium size bullocks. The cost of the implement is only Rs. 30.00 to Rs. 45.00. The Egyptian and West Asian ploughs very much resemble to the Indian blade harrow.

1.3 Problems Associated with Blade Harrow

The major problems associated with the Bakhar blade are its tendency to get choked up with weeds and soil after working for a short distance in light soil, which needs frequent lifting of the implement. It is observed that the moist soil sticks on

to the blade surface in black heavy soil during operation. Being light in weight the blade is unable to penetrate into the soil after 2-3 days of rainfall cessation. The soil and weeds are cut and passed over to the blade surface without being uplifted. The conventional Bakhar blades are unable to throw the required quantity of soil on intra-row weeds, hence they are left unburied. Usually, the blade rake angle is fixed, making the Bakhar blade unsuitable to cope up with operational requirements. The conventional blades have also been found to show higher draft requirements, thereby causing fatigue to the animals.

1.4 Scope and Objectives of the Present Investigation

The performance of an animal drawn tillage tool is affected by three main factors, namely; initial soil condtion, tool-shape and manner of tool movement. Out of these three factors, a designer has a complete control only over the shape of the tool as the initial soil condition changes from place to place, and the animal power has limited working speed and pulling capacity. The shape of the tillage tool has, therefore, received a considerable emphasis in the past in view of the fact that an ideal tillage tool should perform satisfactorily over wide range of initial soil conditions and depth of operations.

Looking at the use and importance of the blade harrow and considering the availability of animate energy for dryland

conditions, it was thought essential to optimize the shape and size of the blade harrow to get the better performance.

In the light of the above, the present study was undertaken with the following major objectives :

1. To evaluate the performance of the conventional Bakhar blade under controlled soil bin conditions at different rake angles and working depths, and compare its performance with five other shapes namely ; straight, convex, concave, V-shaped and triangular.

2. To study the influence of the design parameters on the performance of the best shaped tool found in (1) above at different rake angles and working depths, keeping the soil parameters constant.

3. To develop empirical relationships for the specific draft, mean weight diameter and inverse performance index of the best found shape in terms of tool, soil and operating parameters.

4. To develop an analytical model to predict the draft of the best shaped tool in terms of soil, tool and operating parameters.

5. To verify the validity of the developed analytical model by comparing its output with experimental results.