

## ARTIFICIAL REGENERATION OF *ACACIA NILOTICA* AND *PROSOPIS CINERARIA* IN RIVERINE FORESTS OF SINDH

G. R. Keerio<sup>1</sup>

### Abstract

The artificial regeneration of *Acacia nilotica* (Babul) and *Prosopis cineraria* (Kandi) species in riverine forests is very important operation for the development of forestry in Sindh. All the operations of regeneration process from seed collection to the protection of regeneration area require special attention in order to obtain the desired success. The artificial regeneration process includes three phases viz. pre-abkalani (before the arrival of inundation water), mid-abkalani (while inundation water is receding) and post-abkalani (after complete receding of inundation water).

The extent of annual regeneration operation depends upon many factors such as, availability of the area, intensity of floods, availability of seed and, the allocation of funds for carrying out the operations. The success of the operation is dependent upon proper aftercare and maintenance of the regeneration area specially the protection from grazing and trampling by animals during first year.

The main objective of re-producing this paper is to refresh the senior foresters about the technique and as guideline for juniors who have recently joined the forestry profession and have not practically seen/witnessed the regeneration process. Other agencies involved in afforestation will also be benefited.

### Introduction

Future of riverine forests depends upon the success of regeneration. It is the key operation of the forestry development process. In order to have fully stocked riverine forests well-planned regeneration operation is essential. Its importance is even greater when the operation is to be carried out artificially. The regeneration operation for growing trees in riverine forests of Sindh is carried out artificially as the natural regeneration cannot be achieved successfully due to the silvicultural characteristics of the species and water regime. Due to continuous drought resulting in non-receipt of inundation in the Indus since 1997, the regeneration operations have not been carried out due to which large blanks have occurred in the riverine forests on the one hand and most of the existing vegetation have either dried or died creating ecological imbalances in the riverine ecosystem on the other.

---

<sup>1</sup> Conservator of Forests, Afforestation Circle Sukkur

This paper describes the riverine forests, phenomenon of inundation and regeneration and the process of artificial regeneration of two indigenous species namely, *Acacia nilotica* and *Prosopis cineraria* in riverine forests of Sindh.

### **Riverine forests**

All the area falling within earthen embankments or flood protection bunds on both sides of the Indus is termed as the riverine tract and locally known as "Kacho". The forests growing in this tract are known as riverine forests. They are the main productive forests of Sindh and are mainstay of forestry in the province. Riverine forests are spread over an area of 595,000 acres. The predominant species grown in these forests are *Acacia nilotica* (Babul), *Prosopis cineraria* (Kandi), *Tamarix aphylla* (Lawa), *Tamarix dioeca* (Lai) and *Populus euphratica* (Bahan). The only source of irrigation to these forests is the annual inundation water in Indus during monsoon (June to September). It is estimated that about 50 percent of forests get inundated at a peak discharge of 0.5 million cusecs, 60 percent with 0.65 million cusecs and, 80 percent with 0.8 million cusecs. The entire riverine tract gets inundated with a flood of 1.0 million cusecs.

### **Phenomenon of inundation and its importance in artificial regeneration**

The Indus, the main river of Pakistan has peculiar characteristics that it flows on a ridge. The phenomenon of inundation water during summer in the Indus is well known since time immemorial. Between June and August, the Indus comes into spate partly due to melting of snow, and later on account of rains in the upper catchment areas, carrying large quantities of water to the ocean. During these months, with peak period generally in August, the normal bed of the Indus is unable to carry the huge discharge and spills itself over its banks. The water spreads out and flooding is controlled by embankments or flood protection bunds (30-40 feet high) otherwise the water used to spread far and wide, resulting in destructions to the crops, habitations, roads, irrigation structures and other properties in the past. The purpose of these embankments was to confine the water within desirable limits so as to flow safely to the ocean without damaging the areas outside riverine belt.

The inundation water is the only source on which the existence and management of riverine forests depends. Whole system of afforestation/ reforestation and the silvicultural practices are dictated by this cycle of inundation. Foresters have been using the inundation water as their basic tool since about a century to regenerate and perpetuate the forests through standardized practices and techniques. Forthcoming part

of this paper describes the technique of artificial regeneration as adopted by the Forestry Department in Sindh.

### **Artificial regeneration process**

The artificial regeneration process in riverine forests includes the following main operations:

- a. Seed collection, storage and treatment.
- b. Regeneration operation (Seed sowing/broadcasting).
- c. Aftercare and protection of regenerated areas.

The extent of artificial regeneration program depends on many factors such as availability of the area either blank or as result of annual clear cuts, intensity of floods in the Indus, availability of seed and the allocation of funds to carry out the operation. Accordingly every Divisional Forest Officer having jurisdiction over riverine forests prepares "Regeneration Programme" well ahead of abkalani season. This programme is based upon the trend of floods during last three years and forecasting for current year and availability of blank areas in each forest. The Regeneration Programme proposed by the DFO having earmarked the areas on maps is verified by the Conservator of Forests and is submitted to the Chief Conservator of Forests, Sindh for approval.

#### **a. Seed collection, storage and treatment**

### **Seed collection**

The main seed source areas are the riverine forests, irrigated plantations, canal and roadside strips and *Hurries*. Seed of Babul and Kandi is collected from the ground, from the top of the trees by using locally-made clippers mounted on bamboo poles or cutting the entire branch with an axe and dragging it down for seed collection. Trees of 15 years age produce good and healthy seed. A common practice is to collect the seed from the animal pens where it has either passed through the digestive system of the animals or has been ejected from the mouth. In both cases it is found with the droppings. The seed collected from animal pens is considered to be the best quality as it is pretreated in the digestive system of the animals and the germination is better than the seed collected directly from trees.

The seed pods are kept in the sun for 8-10 days. The seed is extracted by beating the pods with mettlles, poles or rods, by trampling on the pods wrapped in hessain bags or simply by pressing in hands. Scores of women and children are used for this work. Sieving and winnowing follows for the removal of chaff, small stones and other impurities. Flootation is also used for removing extraneous materials and hollow or dead seeds.

### **Seed storage**

The seed is stored in gunny bags or metal containers at seed stores. Generally at every Range office or staff quarters in the field there are seed stores for temporary storage of seed. Usually year long storage is not required as plenty of seed is available every year. The seed quality and quantity is assured by the Divisional Forest Officer of Afforestation Division and is usually inspected by the senior officers of the department while its storage.

### **Seed treatment**

To hasten germination seed is treated in various ways. It is kept in boiling water for a minute, cooled and kept for 12-24 hours in the same water; soaking in concentrated sulfuric acid for 5-10 seconds for 2-3 times and then washed in running water for two hours to remove all traces of acid; keeping in cow dung for a week.

### **Regeneration prepared-ness**

For regeneration operations the seed is kept ready a month ahead of the floods, packed in gunny bags, and transported to all the regeneration sites, because afterwards the floodwater spreads, the areas become inaccessible. In addition, the staff is alerted, boats are hired and, labour is arranged prior to regeneration operation.

#### **b. Regeneration operation**

In the riverine forests the use of inundation water for assisting artificial regeneration of *Acacia nilotica* & *Prosopis cineraria* species is divided into three phases. These are "pre-abkalani", "mid-abkalani" and "post-abkalani. Accordingly, the sowing operations are carried out: i) before river inundation ii) while floodwater is still standing in the area-being on decline and iii) after the flood water has totally receded

**i. Pre-abkalani sowing**

This operation is usually carried out during the months of May and June. This phase of regeneration is carried out in those sites which are problematic and difficult to tackle without prior soil working such as, grassy, hardpan and high lying areas. In such areas soil working operations mainly ploughing with country plough or tractor, seed drilling and wherever necessary land scrapping are carried out before the arrival of floodwater. Apart from this *Tamarix dioeca*, which is a colonizer of flood prone areas, cleared from the site and strips are prepared. These are known as regeneration blocks. After clearing the strips the seeds of *Acacia nilotica* & *Prosopis cineraria* mixed in the ratio of 3:1 are broadcast before flooding. This method is adopted in the areas, which are exposed to cold winds and liable to frosts. In this case the *Tamarix* species provides a good shelter for the young Babul and Kandi crop. During this phase of regeneration approximately 10-15 percent of the total targeted area is covered.

**ii. Mid-abkalani sowing**

This operation is usually carried out in the months of July and August. This phase of regeneration process is very important during which vast areas are sown (85-90 percent of the total targeted areas) annually. Any managerial/technical or otherwise lapse during this phase will result in poor regeneration or in case the areas which could not be regenerated in this phase, will have to be carried out next year.

While the floodwater is receding the seeds of Babul and Kandi in the ratio 3:1 are broadcast manually. The seed is not broadcast unless it is certain that the floodwater will soon start receding. 20 to 25 people join together and take as much seed as they can easily carry and broadcast the seed with both hands, ensuring no blanks are left. This operation is carried when the water is knee-deep. In case the water is deeper small boats are used to broadcast the seed.

This phase of regeneration requires careful consideration regarding the depth, speed and the recharge of the floodwater. Hence, the watching of flood trend is very essential as the regeneration carried out either in deep water or speedy water may fail on the one hand, and large quantity of seed be taken away by the flowing water without reaching the ground on the other.

**iii. Post-abkalani sowing**

This operation is usually carried out during the months of September and October. This is in fact a follow up phase of the previous phases. After all the water has receded and there is still moisture available in the soil, the regeneration area is visited

/surveyed. Where ever blanks are found post abkalani operation is carried out. All the blanks are filled in by drilling and dibbling of Babul and Kandi seeds. They are described in detail in the following paragraphs.

### **Drilling**

Drilling is carried out by using bullocks or tractors. The operation is started as soon as the ground is dry enough to withstand the weight of bullocks or small tractors and have sufficient moisture for the seed to germinate. To the handle of an ordinary country plough, drawn by a pair of oxen, a long wooden pipe with a funnel-shaped top is tied. As the bullocks go on ploughing the area, the man behind the plough keeps pouring the seed into the funnel with his hand and the seed thus falls right into the furrow. Tractor-driven drills are also used nowadays. When properly carried out the method is very successful, especially where large alluvial areas are to be regenerated.

### **Dibbling**

The dibbling is carried out manually. This consists of digging the pits 15 cm deep with spade, placing 4-5 seeds in one pit and covering them with 1-2 cm loose soil. Spacing of 2\*2 meter is generally followed. The method is more economical in the use of seed, the regeneration is evenly distributed and, when carried out at proper time it gives very good results.

### **c. Aftercare and protection**

After the regeneration is completed and the seeds have germinated, the success and establishment of regeneration depends upon many climatic (frosts, moisture supply and storms) and biotic (weeds, grazing, man, insects etc.) factors.

### **i. Climatic factors**

Babul and Kandi trees possess all characteristics of xerophytic species and can be grown with a small amount of moisture. The most devastating climatic factor for young regeneration is the occurrence of frost. The regeneration is completed in the months of September and October. Frost which generally occurs during January and February can cause heavy damage to Babul seedlings. In severe frosts, pole crops of Babul are killed outright. In the riverine tract, the areas, which receive regular adequate flooding, and those areas close to the river banks suffer considerably less damage.

## ii. Biotic factors

Due to favorable moisture conditions in the riverine forests there is luxuriant growth of weeds. These weeds exert a lot of competition for sunlight, water, growing space and nutrients on young plants.

The riverine tract is thickly populated with animal population. Hence, there is tremendous grazing pressure on the regeneration areas. Although all kinds of domestic animals and livestock cause damage to the seedlings of Babul and Kandi but the camels and goats are the worst enemies. As the regeneration areas contain a lot of palatable grasses and small seedlings which attract the livestock and other animals for grazing and browsing. In order to avoid the damage to the seedlings by grazing and browsing and trampling the regeneration areas are fenced with brushwood of trees. Apart from this till the regeneration is established watchers are appointed so that the regeneration area can be saved from grazing. Their main responsibility is to protect the area from grazing.

There is no insect and disease attack to the newly grown seedlings of Babul and Kandi. Some wild animals like porcupines, pigs and rats also damage the regeneration to smaller extent.

*(Note: It is not a research paper. As it contains a lot of practical information hence, published for forest professionals and general public)*