

THE KENYA FORESTRY RESEARCH INSTITUTE

Technical Note No. 23



INTERIM GUIDELINES FOR TREATMENT
OF NATURAL REGENERATION OF *PINUS*
PATULA IN CLEARFELLED AREAS



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TABLE OF CONTENTS

Summary	1
1. Introduction	2
2. Selection of Stands	3
3. Enhancing Natural Regeneration	4
4. Procuring Natural Regeneration	4
5. Tending	5
6. Pruning	6
7. Thinning and Clearfelling	7
8. Improving the guidelines	8
9. Acknowledgements	8
10. References	9

SUMMARY

Pinus patula is one of the major plantation species in Kenya representing about 36 percent of the forest plantations managed by the Forest Department. The species has been mainly established by raising seedlings in the nursery and planting them in the areas prepared by farmers under the shamba system. However, the shamba system was stopped in 1990. These guidelines describe an alternative method of regenerating *P. patula* through a natural regeneration system without the shamba system. The system is based on experiences gained from a natural regeneration trial of *P. patula* established in Lorenge Forest Station.

1. INTRODUCTION

Pinus patula was introduced in Kenya in 1926, but planting on a commercial scale did not start until 1940s (Paterson in Wormald 1975). According to FAO (1989) the area under *P. patula* was 56 000 ha which represented 36 percent of the total area under commercial forest plantations. The establishment of *P. patula* plantations has mainly been through seedlings raised in the nursery for 8 to 9 months before planting.

Pinus patula is mainly planted in high altitude areas (2000 to 2600 m a.s.l) through the shamba system as elaborated in the Forest Department Technical Note No 48. Survival of seedlings planted through this system is generally high (80 percent) because they are protected against weed competition and vermin damage. Although the shamba system has been successful in establishing plantations, the system was stopped in some areas in 1990 due to rampant abuse. However, alternative methods had not been developed and this contributed to poor survival rate of plantations and backlog in afforestation.

As an alternative to the shamba system, the present guidelines describe operations that are required to raise *P. patula* while taking the advantage of natural regeneration. Compared with other methods of plantation establishment, managing natural regeneration is cheaper because the establishment costs are reduced (Isango and Saramaki 1999). Another advantage is that naturally regenerated trees have thin branches, an important attribute for good timber quality, because the stand density is usually high. Moreover, the quality may be improved by selecting the best saplings during earlier treatment. The main problems associated with the management of natural regeneration are ensuring that the seedlings are uniformly distributed and the timing of the initial thinning which would result in the rapid growth and good quality crop.

2. SELECTION OF THE STANDS

2.1 The climatic factors that favour heavy seedlings and thus enhance natural regeneration of *P. patula* are high rainfall and high altitude. Stands that are to be naturally regenerated should therefore be located in areas with average annual rainfall of more than 1200 mm and altitude of more than 2000. In these areas, the regenerates are usually present in stands with open crowns (Fig. 1).

If the land is owned by the Forest Department, priority shall be given to stands in less accessible areas and on steep slopes. The identified site shall be surveyed, given a management unit number (e.g compartment No.) and included in the annual program of work of the relevant Forest Station. The sketch map and the area shall be sent to the Survey and the Inventory Unit at the Forest Department Headquarters.



Fig1. A stand of *P. patula* showing one year regeneration growing under old trees

3. ENHANCING NATURAL REGENERATION

There shall be no grazing and browsing in an area that has been selected for treatment of natural regeneration. An area selected for natural regeneration management must be protected against fire.

4. PROCURING NATURAL REGENERATION

4.1 At the time of clearfell, the quality of the stand shall be inspected to determine if it is suitable for natural regeneration management. A suitable stand is one where the trees are of good form and high growth vigour. Three months after the rains the area shall be inspected again. If the distribution of the regenerates is uniform (with few gaps of not more than 3m diameter), the area is suitable for the management of natural regeneration (Fig.2).



Fig 2. A natural regeneration stand of *P. patula* suitable for treatment.

- 4.2 Two to three years after clear-felling, estimate mean top height of the regenerates from one metre diameter circular plots laid systematically at the intersection of grid of 25 m x 25 m square plots. If the mean top height of the regenerates is between 1.5 m to 2.0 m start the treatment, or postpone the treatment until this mean top height is attained.
- 4.3 Identify and select the regenerates to be retained by choosing the dominant saplings nearest to the intersection of a 3 m x 3 m spacing grids, temporarily laid in the stand. This selection provides an equivalent of approximately 1110 stems per hectare.

5. TENDING

- 5.1 Clean the area by slashing all the vegetation to the ground level and pruning to half height of the regenerates selected in 4.2. Great care should be taken not to injure the regenerates. On completion of this operation the stand will look as shown in Fig. 3 and if not thinned, 5 years later the stand will look as shown in Fig 4.



Fig. 3. A three years old naturally regenerated stand of *P. patula* after thinning to a spacing of 3 m x 3 m and pruned to half height.



Fig. 4. Unmanaged eight years old natural regeneration stand of *P. patula*

- 5.2 Although *P. patula* seedlings of more than two years old require little weeding, weekly inspection and action for occurrence of climbers should be done. Trees should be pruned to half height if found necessary.
- 5.3 The inspection recommended in 5.2 should include animal damage. In case of animal damage, the stand should be protected against grazing by domestic animals.

6. PRUNING

- 6.1 The objective of managing *P. patula* stands is either for production of pulpwood (Category I) or saw and plywood logs (Category II). The pruning schedule for the two categories are shown in Table 1. Pruning at 11 years shall be combined with the first thinning. Pruning shall therefore be done before the thinning so that the trees marked for thinning are not pruned.

Table 1. The pruning schedule for *P. patula*

Age (years)	Pruning height	Approximate mean height of the stem (metres)	No. of trees to be pruned per ha	
			Pulpwood logs	Saw logs and plywood logs
2-3	1/2 height	1.5	All	All
4-5	1/2 height	3.5	All	All
7	1/2 height	5.5	N/A	600
9	1/2 height	7.5	N/A	600
11	1/2 height	9.5	N/A	600

7. THINNING AND CLEAR-FELLING

- 7.1 The objective of all the thinnings is to increase the value of the crop at the rotation age. To safeguard this principle the trees removed during thinning should be those infested with insects or disease, crooked, bending, forked and with unusually large branches, with more than one leading stem, small or suppressed, mechanically damaged, or dead.
- 7.2 All thinnings should be sold and if there is no market during the year, the prescribed thinning may be delayed for a year or two; **after which it must be done.**
- 7.3 The thinning schedules are presented in Table 2. The stands for pulpwood (Category I) shall not be thinned.
- 7.4 Clear-felling of stands for production of pulpwood will be at 18 years, those for saw logs at 27 years and plywood logs at 35 years. Clear-felling may however be delayed to enable sale of the produce.

Table 2. The thinning schedule for *P. patula* stands

Age	Approximate number of trees per hectare before thinning	Trees per hectare after thinning	Trees removed per hectare	Fraction of trees left
11	1110	600	500	6/11
16	600	400	200	2/3
21	400	150	250	3/8
27	250	80	170	8/25
35	80	Clearfell	-	-

8. IMPROVING THE GUIDELINES

These guidelines are preliminary because they are based on limited experimental data. There is need to continue field research to collect more data on growth and yield of natural regeneration stands. The necessity for this research is even more urgent because the pruning and thinning schedules are based on current instructions for the plantations raised by planting seedlings.

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10. REFERENCES

- FAO 1989. Kenya Forestry Sub-Sector Development; Interim preparation reports No.64/89: CP-KEN 22. FAO, Nairobi.
- Forestry Department Technical Order No. 48. Plantation establishment by Shamba System. Forest Department, Ministry of Environment and Natural Resources, Nairobi.
- Isango, J. and Saramaki, J. 1989. Establishment of natural regeneration management trials of *Pinus patula* in Kiwira Forest Project, Tanzania. In: Pukkala, T and Erikäinen, K (Eds): Growth and yield modelling of tree plantation in South and East Africa. University of Joensuu, Faculty of Forestry, Research Notes No. 97.
- Wormald T. J. 1975. *Pinus patula*. Tropical Forestry Papers No 7, Department of Forestry, Commonwealth Forest Institute, University of Oxford.