

## 5 Direct sowing and planting nursery seedlings

Once the species to plant have been determined, the seeds collected, seedlings produced and the soil prepared, the planting activities can begin. Both seeds and seedlings from trees, shrubs or grasses, are directly used in restoration plantations for improvement of degraded agro-sylvo-pastoral systems. It is particularly important to pay attention to the planting period, as well as the planting density or seeding proportion per surface area.

### Plantation density

Although nursery seedlings tend to have a greater survival rate, direct seeding may be more cost-effective, especially in the case of large-scale restoration where surface areas are to be covered and large quantities need to be planted. Grass seeds particularly must be sown directly, so are woody seeds; and this can be done in dry soil before the rains. As mentioned previously, it is advisable to use a mixture of a minimum of 10 species per hectare, combining annuals and perennials to maximize social and ecological functions and resilience.

In drylands a balance can be found by maximizing tree density without compromising groundwater resources; it has been demonstrated that an intermediate tree density facilitates maximizing the groundwater recharge (Ilstedt *et al.*, 2016). It is however difficult to determine the ideal tree density as this depends on the species used and the environmental factors including annual rainfall. Even in the case where the tree density of the reference ecosystem is much lower, the planting density can be much higher to compensate for possible mortality during the first years after plantation, due to factors such as drought or animal browsing, or in case of success, to revisit the spacing years later through thinning, which would provide fuelwood.



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The following numbers can be used as references for tree planting density in the Sahel:

- **High density** (e.g. village woodlots, production of fuelwood):  
up to 1 000 seedlings per hectare;
- **Lower and intermediate density** (e.g. inter-village lands, sylvo-pastoral lands):  
between 625 and 1 000 seedlings per hectare;
- **Low density** (e.g. agroforestry systems, spacing for crop production):  
between 100 and 625 seedlings per hectare.

Tree seedlings and seeds should be combined with herbaceous fodder seeds of at least 3-4 species. Seeds are planted by direct seeding at a recommended ratio of 3-5 or 5-10 kg per hectare, depending on species.

## Planting in the field

Planting activities (direct seeding and tree seedling) are labor-intensive, however, they present a greater opportunity for directly involving communities in the restoration of their landscape (even more so if land preparation has been made by machines). Therefore, the appropriate amount of time should be dedicated to providing demonstrations on planting and seeding techniques for participants, thus heightening their sensitization and part taking.

The best time for planting in drylands is when the soil has sufficient water to allow germination of seeds. It is equally important to ensure the maximum water supply during the first weeks after planting the seedlings. In the Sahel, given the increasing variability and uncertainty in rainfall patterns due to climate change, it may be unwise to plant immediately after the first rain but rather after the first rains have settled in.

The first step is to mark where each tree will be planted according to the plantation plan (e.g. three seedlings per half-moon). A hole must be dug that is large enough for each seedling and preferably immediately before the seedling is placed inside, thus minimizing the drying up of the soil. The seedling container must always be removed before planting and properly disposed of. The soil around the planted seedling should be slightly compacted to remove all empty spaces/cavities around the roots.