Feed the Future Tanzania Kilimo Tija Activity

Technical Bulletin: Sowing

INTRODUCTION

This technical bulletin aims to provide guidance on the practice of sowing. Sowing is the process of putting seeds in (at the appropriate depth) or on the growing medium for germination. Sowing can be done directly in a growing medium or in the nursery and after transplanted to the final growing medium, depending on the type of crop. Horticulture crops can be sown directly or in nurseries depending on the cost of seeds, growing medium, and technology applied.

THE IMPORTANCE OF PROPER SOWING

Sowing ensures that crops are planted uniformly and at the appropriate distance to maximize production. The ideal distance between rows, the distance between plants, the type of planting, and plant density on any given farm are factors that farmers and extensionists should consider throughout the crop cycle. The practice of proper sowing according to crop type has multiple benefits for farmers:

a) **Strong Root Development:** Proper spacing of seeds allows roots to develop at the ideal rate for efficient absorption of nutrients from the soil, without affecting the growth of other plants. Strong roots promote improved productivity.
b) **Efficient Use of Space to Maximize Yields:** Especially for smallholder farmers with limited access to land, sowing to ensure the ideal plant density that promotes maximum yield potential on the land for crops is essential.
c) **Improved Implementation of Management Practices.** Proper sowing facilitates farmers' ability to implement management practices such as weeding, pesticide application, sanitary pruning, etc.

METHODS OF SOWING

The best method of sowing depends on the crop type as it is directly related to how roots develop and specific environments. Some examples of sowing methods include: **direct sowing**, use of slips in direct sowing, and transplanting seedlings to the field after the use of **seedling trays and nurseries**.

Direct sowing is the process of planting the seeds straight in the soil instead of starting them in the nursery and moving them to the field as seedlings. Direct sowing can be beneficial to certain crops whose roots should not be disturbed during transplanting. Examples of these crops include watermelon, pumpkin, squash, cucumber, butternut squash, Irish potato, okra, and carrot. The process of planting **slips** or vines directly into the soil can be beneficial to some crops, such as sweet potato and orange-fleshed sweet potato, and has the benefit of pest and disease resistance.


Figure 1: Direct sowing by hand

Because the root systems of crops differ, the ideal sowing type and plant density is unique to each crop. Table 1 provides some examples of horticultural crops and the guidelines for proper sowing.

Table 1: Sowing and Plant Density by Crop

Crops	Distance Between rows mts	Distance Between plants mts	Type of planting	Linear meters per acre	Population recommended per acre	Type of Sowing
Cabbage	1.50	0.30	two lines (zig zag)	2,700	18,000.00	Seedling trays
Carrots	1.50	0.05-0.06	4 rows per bed	2,700	216,000.00-180,000.00	Direct sowing
Cassava	1.50	0.40	single line	2,700	6,750.00	Direct sowing
Cucumber	1.50	0.20	single line	2,700	13,500	Seedling trays or Direct Sowing
Hot Pepper	1.50	0.80	two lines (zig zag)	2,700	6,750.00	Seedling trays
	1.50	0.50	single line	2,700	5,400.00	Seedling trays
Irish Potato	0.90-1.00	0.20-0.25	Single line	4,444-4,000	16,000.00-22,222.00	Direct Sowing
Lettuce	1.50	0.40	3 rows per bed (zig zag)	2,700	20,250.00	Seedling trays
Maize Grain	1.50	0.17-0.20	2 rows per bed (zigzag)	2,700	31,764-27,000.00	Direct Sowing
Corncobs	1.50	0.30	2 rows per bed (zigzag)	2,700	18,000	Direct Sowing
Melons	1.50	0.40	single line	2,700	6,750.00	Seedling trays or direct
Okra	1.50	0.30	single line	2,700	9,000.00	Direct sowing and seed trays
Onions / Scallions	1.50	0.08-0.10	6 rows per bed	2,700	202,500.00-162,000	Seedling trays or nursery
Onions	1.50	0.08-0.10	4 rows per bed	2,700	135,000.00-108,000.00	Seedling trays or nursery
Sweet corn	1.50	0.30	2 rows per bed (zig zag)	2,700	18,000.00	Seedling trays
Sweet pepper	1.50	0.40	two lines (zig zag)	2,700	13,500.00	Seedling trays
Sweet potato	1.50	0.30	2 rows per bed (zig zag)	2,700	18,000.00	Slips (direct)
	1.50	0.15	single line	2,700	18,000.00	Slips (direct)
Tomato, Plum	1.50	0.30	single line	2,700	9,000.00	Seedling trays
	1.50	0.40	single line	2,700	6,750.00	Seedling trays
Tomato, Salad	1.50	0.40	single line	2,700	6,750.00	Seedling trays
Tomato Salad	1.50	0.50	Single line	2,700	5,400.00	Seedling trays
Tomato Indeterminate	1.50	0.50	Doble line (zig zag)	2,700	10,800.00	Seedling trays
Watermelon	1.50	1.00	single line	2,700	2,700.00	Seedling trays or direct
Zucchini	1.50	0.40	single line	2,700	6,750.00	Seedling trays

SEEDLING TRAYS AND NURSERIES

Horticultural crops, especially vegetables, have limited time for root growth and development due to their relatively short crop cycles. The majority of the root multiplication and growth happens within the first 50 days after sowing. Considering the importance of roots in plant nutrition and the timeline for root development, sowing in seedling trays and nurseries is an important practice to maximize crop yields and minimize losses. A seedling tray in a nursery setting allows the roots to fully generate before transplanting, as shown in Figure 2.

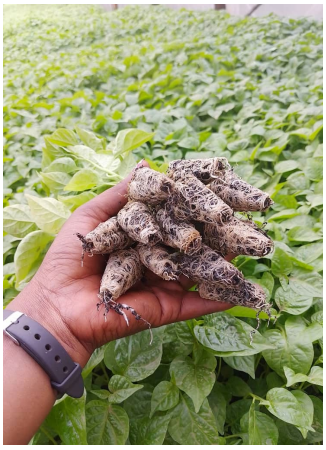

Figure 2: Roots after development in tray
Photo: Fintrac Global Inc.

Seedling Trays: Seedling trays are trays with individual cells for seed germination. The trays are filled with soil and typically sown with 1-3 seeds each (depending on the crop). The trays are placed in a germination chamber as seeds germinate. Seedling trays allow for greater control of the environment and also promote healthy root development. Once the seeds germinate, they are transferred to a nursery for management.

Nurseries: Seedling trays located in nurseries allow for further control of the growing environment as these structures help regulate pests, moisture, and temperatures. Depending on the crop, the ideal time for seedlings to spend in the nursery could be between 2-3 weeks or up to 45 days (as is the case with onion) before transplanting to the field.

Nursery structures are made with timber, shed net, white polyethylene sheets, and soil media. Effective growing media in nurseries include forest soil, industrial soil, and peat moss. Peat moss is the preferable media but requires sterilization before seed sowing.

Figure 3: Soil sterilization

Figure 4: Seed sowing in trays

Figure 5: Germination chamber

Figure 6: Seedlings in nursery

Photos:
Figures 3 & 5: Fintrac Inc.
Figures 4 & 6: Fintrac Global Inc.

NURSERY COSTS

Implementing a nursery for specific crops that have high potential to benefit requires an initial investment, but results in healthier production and higher yields. There are also different levels of nurseries depending on the farmer's ability to invest. The following tables demonstrate average budgets for an advanced nursery (Table 2) and a simple nursery (Table 3) that both accommodate 100 trays and provide benefits to the farmer.

Table 2. Budget for Advanced Nursery to Accommodate 100 Trays (TZS)

Material	Unit	# of Unit	Cost per Unit	Total
Trays	piece	100	2,000	200,000
Shed net	roller	1	350,000	350,000
White polyethene sheet	M	10	30,000	300,000
Poles	piece	20	80,000	1,600,000
Wood	piece	60	4,000	240,000
Nail	kilogram	10	3,000	30,000
Digging hole	piece	30	800	24,000
Ufundi	people	2	700,000	1,400,000
Total				**4,144,000**

Table 3. Budget for Simple Nursery to Accommodate 100 Trays (TZS)

Material	Unit	# of Unit	Cost per Unit	Total
Trays	piece	100	2,000	200,000
Shed net	roller	1	350,000	350,000
White polyethene sheet	M	10	30,000	300,000
Poles	piece	20	10,000	200,000
Wood	piece	60	500	30,000
Nail	kilogram	5	3,000	15,000
Digging hole	piece	30	250	7,500
Ufundi	people	1	50,000	50,000
Total				**1,152,500**

As demonstrated in the tables above, nurseries can be customized depending on the needs and abilities of different farmers.

Figure 7: Advanced nursery

Figure 8: Simple nursery

Photos Figures 7 & 8: Fintrac Global Inc.

BEST PRACTICES FOR TRANSPLANTING

Transplanting is the process of transferring seedlings from the nursery to the field. The day before transplanting, farmers should acclimate their seedlings through the "hardening off" process, which helps prepare crops for transplant and increases the likelihood that they will continue to grow successfully in the field. Best practices during transplanting include:

a) **Soil Moisture**: The soil should be very humid for transplant. This helps reduce transplant shock and ensures that the soil has enough water reserve for the water stress and to induce roots.
b) **Depth**: Do not transplant the plantlets beyond the recommended depth.
c) **Air Content**: There should be no air bubbles around the plantlets or seedlings.
d) **Handling**: Avoid rough handling of the plantlets.
e) **Supervision**: Ensure close supervision of transplanting.

CONCLUSION

Proper sowing based on the crop under production is a valuable practice for Tanzanian farmers to maximize root development and yields. By understanding the benefits and appropriate application methods per crop, farmers can promote healthy root growth. The use of seedling trays and nurseries (when appropriate for the specific crop) can further contribute to productivity by allowing control over additional environmental factors. While nurseries involve an initial investment by the farmer, there are ways to customize nurseries to decrease up-front costs and still provide significant benefits. These practices contribute to improved yields and long-term agricultural sustainability in Tanzania.