Farmers Guide to Grafting Techniques for MICCA project

Mwongozo kwa Wakulima wa Uoteshaji Vipandikizi Kwa Mradi wa MICCA

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For MICCA project

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**Introduction**

Grafting is a technique widely used in horticulture and forestry for the mass production of selected plants, and is one of the most successful methods for propagating selected plants. The technique involves formation of a union between scions taken from desirable mother trees and rootstocks that are normally young, healthy seedlings established in the nursery. Grafting can, however, also be carried out onto trees that are already established in the field.

As well as allowing the cloning of superior individuals, if done with the right plant material grafting can shorten the period between field establishment and when a tree flowers and fruits. This is important for fruit trees, since earlier maturity means revenues can be realized more quickly by farmers.

To achieve a successful graft, it is important to have healthy, actively growing rootstocks, as well as scions with active (swollen) buds that have not yet opened.

Normally, scions and rootstocks should be of the same diameter, in order to align cambium layers. This is required for the formation of the graft union, to allow the effective movement between roots and shoots of the nutrients and water needed for plant growth.

**Utangulizi**

Uoteshaji kwa kutumia vipandikizi ni mbinu ambayo hutumika sana katika kilimo cha matunda na mbogamboga, na misitu kwa ajili ya kuzalisha miti maalum kwa wingi.

Mbinu hii hutumia kwa kuunganisha kati ya vipandizi viliyochukuliwa kwene kwa mtu mama na mashina ya michi yenyewe afya bora iliyopo kwene bustani. Pia kufanyika kwene kwa miti ambayo tayari imepandwa katika shamba.

Pia inawezesha miti kuwa bora, ikifanyika na vipandikizi sahihi, njia hii ya kuotesha kwa vipandikizi kusaidia kuharakisha miti kutoa maua na matunda. Ni muhimu kwa miti ya matunda, uwivishaji wa mapema wa matunda huleta kipato kwa haraka kwa wakulima.

Ili kufanikisha uoteshaji wa mmea kwa kutumia vipandikizi, ni muhimu kuwa na mashina yenye afya bora na yanayoweza kukua, pia vipandizi viwe na vichomozi vinene ambayo havijaanza kuchomoza.

Kwa kawaida, vipandizi na mizizi lazima viwe na unene ulio sawa, ili kuwezesha mpangilio wa kambiam kuwa na tabaka sawa. Hii inahitajika kwa ajili kuwezesha muunganiko wa vipandikizi, pia husaidia kuratibisha mzunguko wa virutubisho na maji kati mizizi na shina kwa ajili ya ukuaji mzuri wa mmea.
Scion selection, collection and storage

Scions should be collected from actively growing trees that show no signs of disease or pest attack. Scions are best taken from terminal shoots with actively growing buds (swollen buds about to open). The use of vertically growing (orthotropic) shoots is best, but otherwise shoots growing at up to 45 degrees from the vertical can be used. The diameter of the scion should match with that of the rootstock and should be between 5 and 15 cm long.

After selecting and removing the scion from the tree, all leaves should be removed immediately to reduce moisture loss through transpiration. Scions should be wrapped in moist cotton wool, moist paper towels or moist newspapers and placed inside a plastic bag. This should then be kept in a cool box with ice, to keep the scions at a temperature of 5 to 10°C. If ice is unavailable to collect scions, temperature can be minimised by keeping the cool box in a shady place. For long term storage (more than 2 days), scions can be kept in a refrigerator, but it is advisable to use scions as soon as possible after collection.

Uchaguzi, ukusanyaji na utunzaji wa vipandizi

Vipandizi lazima vikusanywe kutoka kwenye mti unao kuwa vizuri na havijaonyesha dalili za kuingiliwa na magonjwa au mashumbulizi ya wadudu. Vipandizi bora vichukuliwe mwishoni mwa shina lenye vichomozi vizuri (vichomozi viwe vinene vinavyokaribia kuota). Ni vyema kutumia shina linalokua kulekea juu, vinginevyo shina lililokua hadi kufikia nyuzi 45 kutoka juu inaweza tumika. Unene wa kipandizi lazima uwe sawa na unene wa mashina na lazima uwe na urefu kati sentimita 5 hadi 15.

Baada ya kuchagua na kuondoa vipandikizi kutoka kwenye mti, majani yote yaondolewe kwa haraka ili kupunguza upoteaji wa maji/unyevunyevu kwenye shina kwa njia mnrurisho. Vipandikizi lazima vifunikwe kwa pamba na karatasi yenye unyevunyevu na iwekwe ndani ya mfuko wa plastiki. Na lazima iwekwe kwenye boksi lenye unyevunyevu na iwekwe pamoja na barafu, weka vipandikizi kwenye joto lenye sentigradi 5 hadi 10. Kama barafu haipo, weka vipandikizi kwenye boksi la unyevunyevu penye sehemu yenye kivuli ili kupunguza madhara yatokanayo na joto. Kwa matunzo ya muda mrefu (zaidi ya siku mbili), vipandikizi vitunzwe kwenye friji, ni vyema kutumia vipandikizi mara tu ukusanyapo kwa haraka iwezekanavyo
Grafting methods

Four popular grafting methods are top cleft, side cleft, whip, and whip and tongue. Regardless of the grafting method, scions are generally treated beforehand with fungicide to prevent fungal infections. Grafting equipment should also be sterilised by dipping in 95% ethanol before and between carrying out grafts.

The top cleft grafting method

Cut the rootstock straight across where the diameter of the stem is the same as that of the scion. Then make a clean, straight cut vertically down the centre of the rootstock, deep enough to accommodate the wedge of the scion.

The scion is prepared by making two sloping cuts to form a ‘V’ shape wedge. This is then inserted into the cut in the rootstock, making sure the cambium layers match up.

The point of union is tightly tied with grafting tape and sufficiently covered to make sure water cannot enter the point of union. A clear plastic bag can be used to cover the scion and union in order to prevent excessive moisture loss during wound healing. After 3 to 4 weeks, when new growth appears, the plastic bag and grafting tape are removed.

Njia za Uoteshaji kwa kutumia vipandikizi

Kuna njia nne za kuotesha kwa kutumia vipandikizi zinazofahamika, nazo ni kama inavyooneshwa katika picha hapa.

Vipandikizi kwa ujumla lazima vikingwe kabla ya kupandwa kwa kunyunyuzia au kupulizia dawa za fungasi kuzuia magonjwa ya fungasi. Vipaa vya kuoteshea vipandakizi lazima vikingwe kwa kuzamisha zaidi ya asilimia 95 kwenye ethanol kabla na wakati wa kuotesha.

Kuotesheja kwa juu

Kata mshina uliyonyoka wenywe ukubwa sawa na kipandikizi. Safisha, kwa juu kuelekea chini karibia katikati ya mshina, nenda ndani vya kutosha ili kipandikizi kinge vizuri.

Kipandakizi lazima kiwe na pande mbili zenye mwinuko wenywe umbo la “V”. Halafu ingiza kipandikizi kwenge kishina, hakikisha tabaka la mungo linaamia.

Munganisho ufungwa na tepu vya kutosha ili kuzuia maji yasingie ndani. Plastiki inaweza tumika katika munganisho ili kuzuia maji yasipotee wakati wa kukata.

Plastiki na tepu ondolewa baada ya wiki 3hadi 4, mara tu ukuaji unapotokea

Top cleft grafting method

*Uunganishaji kipandikizi kwa juu*
The side cleft grafting method

A shallow, slanted cut 3 to 4 cm long is made along the side of a healthy rootstock. The base of the scion is also trimmed to match with the incision made on the rootstock. The scion is then inserted into the rootstock incision, and scion and rootstock are bound tightly together with grafting tape.

After 3 to 4 weeks when a firm union has formed, the terminal portion of the rootstock (about 3 to 4 cm above the point of union) is cut away. Grafting tape is then removed.

Uoteshaji wa vipandakizi kwa pembeni

Kipandikizi chenyе kina kifupi, kata kwa urefu wa sentimita 3 hadi 4 wenye kishina kilicho bora. Lainisha na weka tundu na ingiza kwenye kishina, funga pamoja na kaza na kifungio.

Baada ya wiki 3 hadi 4 wakati muungano imejengeka, sehemu ya juu ya vipandikizi (kuhusu 3 hadi 4 sm juu ya sehemu ya muungano) inakatwa. Ondoa kifungio baada ya kuota.
The whip grafting method

The whip graft is difficult for the beginner but is a relatively quick method once mastered, and is the best approach for grafting onto field (rather than nursery) plants.

Make a matching sloping cut about 3 cm long at the base of the scion and on the rootstock with a sharp knife. If the stock and scion are not the same size, match the cambium layers on one side. Secure the scion to the rootstock with a rubber band and then with grafting tape. A clear plastic bag is used to cover the scion and union to prevent excessive moisture loss prior to healing. The graft is successful when the scion produces new growth, the plastic bag and grafting tape are then removed.

The whip and tongue grafting method

The whip and tongue method uses interlocking cuts that help to hold the scion and rootstock together. It is the best technique for small diameter (0.8 to 1.5 cm) rootstocks.

Whip and tongue grafting involves making a long, sloping smooth cut about 2.5 to 6 cm long on the rootstock, followed by a matching cut on the scion. A ‘tongue’ is then made on both the scion and rootstock by slicing downward. The scion is then fitted into the rootstock and the two held together in the normal way with grafting tape, then covered with a clear plastic bag.

Kuotesha vipandikizi kwa ulazo

Kuotesha vipandikizi kwa ulazo ni ngumu kwa kuanzia /mwazilishi ila inakua ni njia ya haraka pale utakapo zoea, na ni njia nzuri kwa kuoteshea vipandikizi juu ya miti iliyo shambani (Kuliko ya bustani).

Tengeneza mwinuko unaofanana kata urefu wa sentimita 3 kuanzia chini ya kipandizi na juu ya mizizi kwa kutumia kisu kikali. Kama unene wa mizizi na unene wa kipandikizi haipo sawa, unanganisha tabaka za kambiam kwenyewe upande mmoja. Linda vipandikizi na mizizi kwa kutumia mpira na tepu. Mfuko sahi wa plastiki hutumika kufunikia kipandikizi na munganisho kuzuia kupotea kwa maji wakati wa kukata. Muunganisho ufani kiwa pindi vipandikizi uta, mfuko ya plastiki na kifungio uondo lewa baada ya kuota.

Njia ya kuotesha vipandikizi kwa kukata na kuoanisha

Njia ya kuotesha kwa kukata na kuoanisha hutumika kwa vipandio inavyobianiana kwa ajili ya kusatidia kushikama kwa kipandizi na kishina kwa pamoja. Ni mbinu bora kwa vishina vyenye unene mdogo kuanzia sentimita 0.8 hadi 1.5.

Njia hii ufanyika kwa kutengeneza mkato wenyewe urefu na mwinuko laini wa kuanzia urefu wa sentimita 2.5 hadi 6 kwa kishina, ukifuatiwa na kipandikizi kinacholingana. Mkato hutengenezwa kwenye kipandikizi na kishina kwa kukata kuelekea chini. Kipandikizi huingizwa kwenye kishina na muungano hushedikiwa pamoja kwa kutumia kifungio, halafu hufunikwa mfuko sahi wa plastiki.
Care after grafting, hardening off and field planting

After grafting, the following practices should be adopted:

- Prevent grafts from drying out by placing under shade and by watering regularly; apply water directly to the soil
- Normally, any shoots other than the scion that grow on the rootstock should be removed

Plastic bags should be removed from scions when they start to shoot, generally between 20 and 40 days after grafting. The grafting tape may remain in place for longer, until a vigorous growth is observed. Grafted seedlings must be hardened before they are transplanted on-farm. This involves a gradual reduction in shade and watering in the nursery.

Field planting should be done at the beginning of the rainy season to allow the plants to establish well before the onset of the dry period.

Matunzo baada ya kuunganisha vipandikizi, Ukomazaji na upandaji wa shambani

Baada ya kuunganisha vipandikizi, Shughuli zifuatazo lazima zifanywe:

- Kuzuia vipandikizi kutokea kwa kukauka kwa kuweka chini ya kivuli na kumwagilia maji, weka maji moja kwa moja kwenyewe udongo
- Kwa kawaida, ondoa shina lolote (isipokuwa kipandikizi) litakalotikeza kwenyewe mehe

Mifuko ya plastiki lazima iondolewe kwenyewe vipandakizi pindi yanapoa mawingu mashina, kwa kawaida ifanyika katikati mwa siku 20 na 40 baada ya graffiti. Munganisho wa tepu inaweze bakia kwa muda mrefu mpaka ukuaji wa haraka utakaponekana. Miche iliyoifanyiwa graffiti lazima ukomazwe kabla kupandwa kwenyewe shamba. Ukomazaji ufanyika kwa kupunguza taratibu kiasi cha kivuli na umwagiliaji wa maji katika bustani.

Upandaji wa shambani lazima ifanyike mwanzoni kipindi cha masika ili kuruhusu mimea kukua vizuri kabla ya kuanza kipindi cha ukame.
Reasons for grafting failure and precautions to prevention

In addition to the use of unhealthy rootstocks, scions at the wrong stage of physiological maturity and not matching the cambium of rootstocks and scions (points mentioned above), the failure of grafting may also be due to factors such as:

- Entry of water into the point of union, thereby promoting mould growth
- Mechanical damage of the cambium region during grafting operation
- Incompatibility of the scion and rootstock.

Precautions that can be taken to prevent failure include

- Graft as soon as possible after scions are taken from the mother tree
- Use sharp instruments to avoid causing unnecessary damage to plant tissues
- Disinfect grafting tools with 95% ethanol
- Cut surfaces must be smooth
- Secure the union tightly to ensure good contact and wound healing
- Provide shade to new grafts to avoid excessive water loss
- Always handle grafts by holding the rootstock, not the scion

Sababu za vipandikizi kushindwa kuota na tahadhari ili kuzuia

Ukiacha matumizi ya mizizi isiyoni na afya nzuri, kutumia kipandikizi kisichokomaan na kutumia cambium za mizizi isiyolingana na vipandikizi (pointi zilizotajwa hapo juu), kushindwa kwa kuota kwa vipandikizi inaweza tokana na sababu kama vile:

- Kuingia kwa maji wakati wa kuunganisha, hupelekea fungasi
- Kuharibika kwa eneo la kambium wakati wa operesheni ya kuunganisha vipandakizi
- Kutowiana kwa mizizi na vipandikizi

Tahadhari ambazo zinaweza kuchukuliwa ili kuzuia kushindwa kuota kwa vipandakizi ni pamoja na:

- Vipandikizi viunganishe kwa haraka iwezekanavyo baada ya vipandikizi kuchukuliwa kutoka mti mama
- Tumia vifaa vya ncha kali ili kuepuka kusababisha uharibifu usio wa lazima wa tishu za mti
- Weka disinfect yenye ethanol 95% kwenye grafting zana
- Nyuso za vipandikizi lazima viwe laini
- Tunza muunganisho kwa kukazwa ili kuhakikisha mawasiliano mazuri ya sehemu zilizounganisha
- Weka kivuli kwenye munganisho mpya ili kuepuka kupotea kwa maji mengi
- Daima shughulikia vipandakizi
The best time to plant a tree was ten years ago
The second best time is NOW

Muda muafaka wa kupanda miti ilikuwa ni miaka kumi iliyopita
Nafasi muafaka ya pili ni SASA