

Eichhe tu rannung ven dan:

Tuaingawt (Sweet potato weevil) hian chhiatna tam tak a thlen thin a. Tuiangawt puitling chuan a kuang leh bal te chu a ci chhe thin a, Ruahtui tlak loh lai hian an cichhe nasa thin hle bawk a, a bik tak in bal (tuber) cho chhuah lo a dah reng khan an lo cichhe hman hle thin. He rannung in a tih chhiat atanga kan chan (loss) theih chu 20-55% vel a ni a, a nasat phei chuan chuan 100% thlengin kan chan (loss) thei a ni.

Aenkawl dan

- Rannung in a ci chhiat loh hrisel tha tak chu a chi a tan thlan thin tur a ni.
- Phun hma in a kuang (cutting) chu Fenthion (0.05%) emaw Fenitrothion (0.05%) solution ah minute 10 chhung chiah hmasak phawt tur.
- Thlai dang hrim hrim rannung in a ci thin te paih fai vek tur.
- Phun atanga ni 30 leh ni 60 hnu ah lei rih vur (carthing up) tih ngei ngei tura ni.
- Sex pheromone trap hman tur. 100 m² huam chhung ah trap khat zel khai tur a ni a, hei hian a pa (male) ho kha a lo hip khawm thin a ni.
- A hun tak ah bal (tuber) kha cho chhuah thin tur a ni. Sweet potato weevil (Cylas formicarius) te hi a hring a, a hmin hnuah a hmin leh a.

Sweet potato weevil hi pest pawimawh ber a ni a, thlai chi a tichhe nasa hle. Weevil puitling chuan vines leh tubers te chu a puncture thin. Grubs te hian tunnel siamin stem leh tubers te chu an bore a, an chawm bawk. Attack hi ruahtui tlak loh lai emaw, loncitateⁿ tubers lakkhawm an tihkhawtlai lai emaw hian a nasa hle. Yield loss hi 100% thlengin a sang thei. A vaiin 20 atanga 55% vel chu tuber hloh a ni.

Integrated pest management (Thil dang dang hmanga ci chhetu rannung enkawldan)

Tuaingawt in a ci chhiat loh hrisel tha tak chu a chi a tan thlan thin tur a ni Cutting chu insecticide chi khat Imidacloprid (tui litre 10 ah 3 ml) ah phun hmain minute 10 chhung chiah hmasak phawt tur. Phun atanga ni 30 leh ni 60-ah lei chhun vum kha tih that leh thin tur. Sex pheromone trap hman tur. 100 m² huam chhung ah trap khat zel khai tur a ni a, hei hian a pa (male) ho kha a lo hip khawm thin a ni. Phun atanga ni 105-110 chhungin bal (tuber) chu cho ngei ngei tur. A chuang bang la awm hman tlak tawh loh ho chu halral vek thin tur. Sweet potato feathery mottle virus: Virus hrang hrang zingah sweet potato feathery mottle virus hi kawlbahra hmun ah hmuh tur a awm nasa hle a, hei natna vang hian 50% thleng kan chan thei a ni. A hnah ah a natna lang chhuak tlangpui a, a chi hrisello hman atang hian he natna hi a darh nasa hle. Virus chi hrang 12 zingah sweet potato feathery mottle virus (SPFMV) hi hmuh tur a tam em em a ni. SPFMV chhinchhiaha langsar ber chu a hnah ahi hmuh deuh thep a, nainawk (purple) rawng in a tial chhuak thin. Rannung chi khat aphid leh a chi (planting material) kan hman atang hian he natna hi a darh chak hle.

Aenkawl dan

SPFMV hi tolerant variety (natna do thei) Sree Vardhini te, natna kai lo a chi tha kan phun hian he natna hi a pumpel theih a ni.

A lak/seng hun:

- Thlai chin hun chhung a zirin thlai puitlin hunah lakkhawm thin a ni.
- A kuang (vine) te leh a bal (tuber) chu ti hmehem lo in laih chhuah thin

tur a ni. A chi tha, pianzia tha leh rannung leh natna in a tih chhiat loh te chu a kum leh a phun atan hman thin tur a ni.

- A kuang (vine) rannung cichhiat loh leh natna kailo chauh te chu phun atan thlan thin tur a ni.
- Cuttings chu phun hma ni hnih chhung chu daihlim ah dah phawt tur.
- Boruak lum lutuk in a tih chhiat loh nan hmum dang a thawn chhuah dawn chuan thlai chinna atana hman tur bal (tuber) leh a kuang (vine) te chu buara ip ah emaw boruak tha tak awmna bawm (container) ah dah thin tur a ni.
- A hnah tlakawh leh a lo eng tan khan bahra chu a cho chhuah theih tawh a, a puitling tawh tih hriat leh dan pakhat chu a bal (tuber) kha chemte hriam in cut tur a ni a, khata a hnai (latex) rawng atang khan a puitling chun a hriat theih a ni. A bal puitling ah chuan a hnai kha cream rawng in a awm anga, a la puitling lo ah chuan a hnai kha a dum vek ang.
- A hun tak ah bal chu lak chhuah tur a ni a, rei tak la chhuak lo a kan dah reng chuan a bal (tubers) te chu an tawih thin a, cichhe tu rannung ten an lo bawm vat thin.
- Awlsam taka lak chhuah theih nan laih chhuah hma ni hnih atanga ni thum chhung chu tui pek thin tur a ni. A kuang (vine) te chu paih hnu ah a bal (tuber) te chu hliam nei miah lo in lak chhuah thin tur.
- A thar chhuah zat : 20 tonne atanga 25 tonne hi hectare khat hmun ah a thar chhuah theih.
- Curing (A sawngbawl dan): Hlawhtling taka dah that leh hralh chhuak tur chuan sawngbawl ve te a ngai a. A bal (tuber) lakkhawm te chu polythene sheet emaw silpauline ah chhap darh vek tur a ni a, hei hian fungal infection 10% a veng thei a, chuan a dah that theih hun (shelf life) pawh 60% in a tisang thin. Curing hian a kawr (skin) kha a ti chhah a, a pilh hrep hrup ho kha a tidam a, natna lak ah a veng bawk. A quality pawh sawngbawl loh ai chuan a tha viau bawk.
- Washing (Silfai): Bal (tubers) sawngbawl tawh te kha faitak in tuiah silfai tur a ni a, lei kai zawng zawng te kha silfai vek tur. A kawr kha kan tih chhiat loh nan fimkhur a ngai hle bawk. He operation hi kut hmangin emaw specialized washing machine hmangin emaw a tih theih a ni. Bal (tubers) vawn that dan:
- Bahra hi dahtha lem lo in kar 2 atanga kar 3 inkar chhungin kan ci tlangpui a. Mahse, kum khat chhung a zung thar awm theihna tur leh bazar ah a man to zawk a kan hralh theih nan dahthat (storage) hi a tul hle a.
- A tlangpuiin bahra sawngbawl tawh chu thla 6-8 chhung temperature pangai tak hnua ah dah that theih a.
- Kan dahthat hnu a a lo tawih neuh neuh awm te hi kan laichhuah lai a kan tih khem neuh neuh (injury) nen khan a inzawm tlat a, hemi pumpelh tur chuan thatak a kan sawngbawl (curing) hnu ah a chhe ho zawng zawng kha paih vek tur a ni.
- Kan dah thatna hman kha a lo that tawh loh chuan bal (tuber) te kha an thawp sut thei a, tuber te kha a lo chawr/tiak bawk a, an lo vuai in natna hrang hrang a lo phah thin bawk.
- Dah that dan dang leh (Ideal storage method) – Bal (tubers) te hi khur chhunga dah in buhpawl hmang in a khuh theih a, thlaruk chhung chhe miah loh in kan vawng tha thei a ni.



Agro techniques for cultivation of orange fleshed sweet potato



Kawlbahra (Sweet potato) serthlum rawng (orange color) chin dan

Kawlbahra (Sweet potato *Ipomoea batatas* L. Lam.) hi tropical tuber thlai chi pawimawh tak zinga mi a ni a, a siam chhuah dan, sum leh pai lama hlutna, caloric leh protcin lama thawhlawkzia te sawi tur tam tak a awm a. Kawlbahra hi South America atanga chin hmasak ber a ni a, ram thang mck tam tak ci tur pawimawh ber pasarihna a ni. Mihring chaw, ran chaw leh industry hrang hrang raw materials atan an hmang nasa hle bawk. Agro ecological zone engemaw zatah chin a ni a, India khawthlang leh hmarchhak biala lo neih leh ci leh in kalphungah hmun pawimawh tak a chang a ni. Kawlbahra hi herbaceous perennial plant a ni a, ci theih tur tubers a siam chhuak thin. Mahse, kum tin thlai angin a chin a, chu chu storage roots emaw vine cuttings emaw hmanga vegetative propagation hmangin a chin a ni. Kawlbahra hi thla 3-5 chhungin a puitling a, famine reserve crop angin lei a khawh tha hle a, unit area khatah productivity sang tak a nei a, marginal soil-ah pawh a to tha hle a, hei hian ci leh in tur atana thlai tha tak a ni.

India ramah chuan kawlbahra hi tribal-te ci tur pawimawh ber pakhat a ni a, chhang (snack) atan an ci a, ran chaw atan pawh an hmang bawk. India rama kawlbahra chinna hmun zawng zawng (orange-fleshed sweet potato tlein) kum 2017-18 chhung khan hectare nuai 130.6 vel a ni a, ton sang 1500 vel an thar chhuak. A chhung serthlum rawng (orange-fleshed varieties) ah hian vitamin A leh beta carotene a tam em em a ni.

Kawlbahra serthlum rawng (orange-fleshed) kan ci hian mihring taksaah vitamin A a lo inkhawh khawm a, hei hian taksain vitamin A tamna ci tur a hmuh tlem lai hian vitamin A kan tlakchham loh nan a pui hle bawk.



Sweet potato plants



Sweet potato tubers

Orange-fleshed sweet potato (OFSP) hian Vitamin A tlakchham vanga Night blindness leh Bitot Spot natna dona kawngah a pui a ni. Orange-fleshed sweet potato (OFSP) tubers hian carbohydrate a pai tam hle a, hei hian ni khatah hectare khatah ci tur chakna tam zawk a siam chhuak thei a, carbohydrates hmuhna pangngai dang, buh leh buhfai aini a siam chhuak tam zawk a ni. Kawlbahra hnah leh a kuang te hi vitamin A, B (thiamine, niacin, leh pyridoxine) leh C awmna tha tak an ni a, protcin, calcium leh antioxidants te pawh a tam hle.

Achi tha (Improved varieties)

ICAR-CTCRI chuan kawlbahra chi hrang hrang siam chhuak a, ci leh in leh nutritional security leh sum laklulna atana quality hrang hrang nei chi 21 a tichhuak tawh a ni. A chi (variety) hrang hrangte chipchiar zawk chu table 1-ah hian tarlan a ni.

Sik leh sa

Kawlbahra hi boruak lum na hmun ah chin thin a ni a. Tuipui atanga atanga teh a 2000 metre thlenga sangah a chin theih a ni. Ni lum leh zan lum hi storage root siamna atan a tha hle, a par chhuah theih nan darkar 11.5 a mamawh bawk. A zung siam nan hian boruak vawt a mamawh a, zung tam tak chhuah tur chuan boruak lum a mamawh bawk.

Kawlbahra hian temperature 21 atanga 26°C inkar hi a mamawh a, ruahtui 75 cm atanga 150 cm a mamawh bakah ni eng tha tak a mamawh bawk, Lei mamawh dan

Kawlbahra hi lei chi hrang hrang ah chin theih ni mahse lei thawl lam deuh ,tui luan chhuahna tha tak, organic matter tam tawh tawm awmna hi an ngeih bik a. Lei thur lam deuh (acidic soil) tuar thei thlai a ni a, acidic soil (pH - 5.5 to 6.5) inkar hi an mamawh tawh a ni.

Aphun hun

Kawlbahra hi fur lai (Junc-August) leh thlasik lai (October-December) hian a chin/phun theih a, thlasik lai phun chuan tui tha in pek a ngai thung. Thlasik a phun hian an thar chhuak hncm zawk a, a chhan chu boruak an mamawh tawh an hmuh vang a ni. February to May thla chhung pawn hmun hniam lam ah chuan an ching thin bawk.

Table 1. Details of improved varieties of sweet potato

Variety	Duration (days)	Yield (t ha ⁻¹)	Year of release	Important features
1. H-41	120	20-25	1971	Semi spreading, reddish purple skin and white flesh with excellent cooking quality
2. H-42	120	22-25	1971	Semi spreading, greenish vine with pink tinge, emerging leaf light purple, storage root fusiform with pink skin and cream flesh
3. Varsha	120	17-22	1983	Semi spreading, reddish purple skin, light yellow flesh, good cooking quality, drought tolerant, susceptible to sweet potato weevil
4. Sree Nandini	100-105	20-25	1987	Spreading, light cream skin, white flesh, good cooking quality, drought tolerant, suitable for paddy fallows as a catch crop
5. Sree Vardhini	100-105	20-25	1987	Semi spreading, purple skin, light yellow flesh, good cooking quality, susceptible to sweet potato weevil, suitable for both rainfed and irrigated conditions
6. Sree Rethna	90-105	20-22	1996	Spreading, purple skin, orange flesh, excellent cooking quality
7. Sree Bhadra	90	20-22	1996	Semi spreading, early maturing variety, light pink skin, cream flesh, good cooking quality, trap crop for root knot nematode, susceptible to sweet potato weevil
8. Gouri	110-120	19	1998	Medium duration variety, reddish purple skin, orange flesh, suitable for Kharif and Rabi seasons, susceptible to sweet potato weevil, tolerant to mid-season moisture stress
9. Sankar	120	13.7	1998	Medium duration variety, spreading type, excellent cooking quality, susceptible to sweet potato weevil
10. Sree Arun	90	20-28	2002	Spreading, pink skin, cream flesh, good cooking quality, early maturing type

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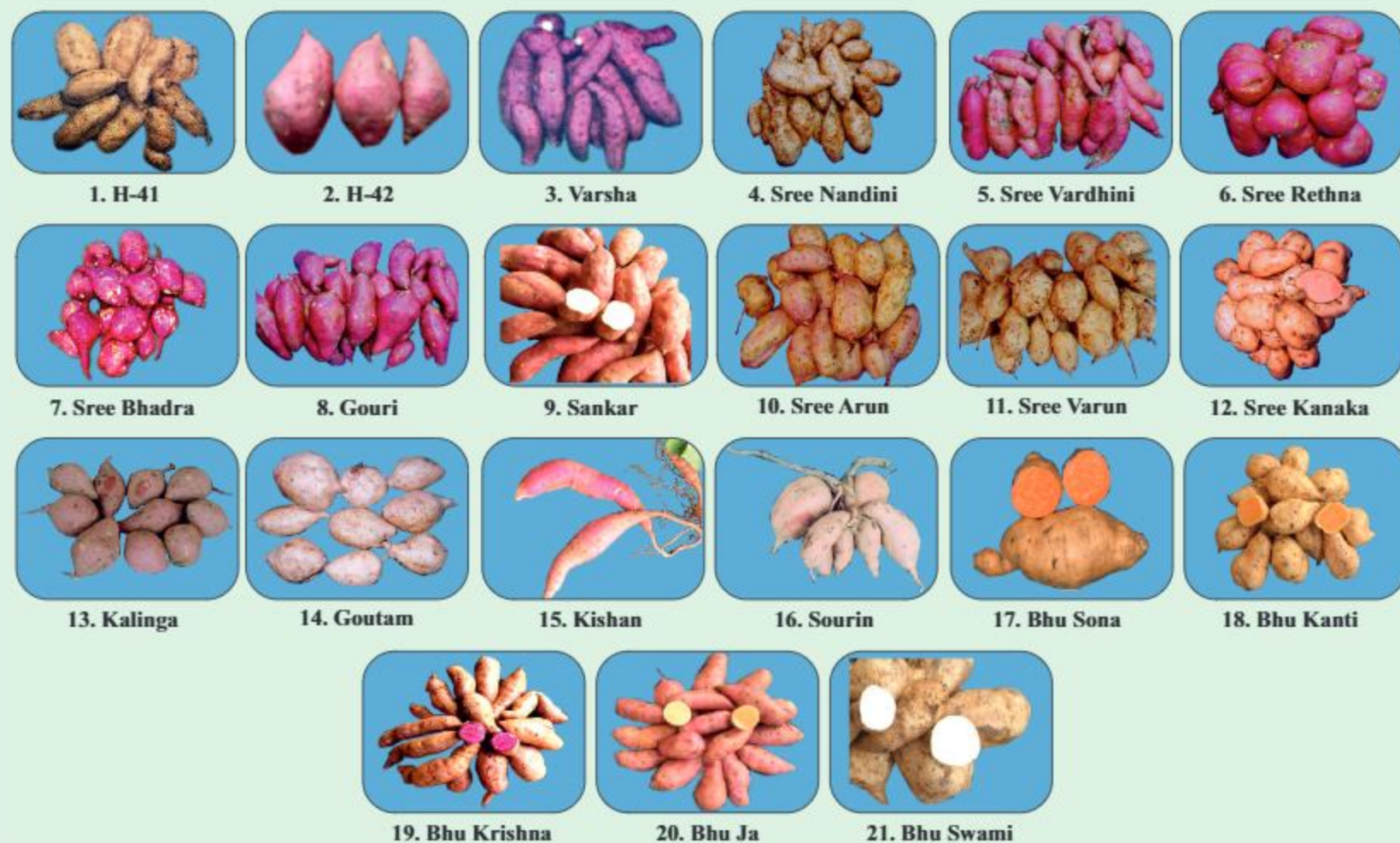
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Variety	Duration (days)	Yield (t ha ⁻¹)	Year of release	Important features
11. Sree Varun	90	20-28	2002	Spreading, cream skin, cream flesh, good cooking quality
12. Sree Kanaka	75-85	10-15	2004	Short duration hybrid, rich in b carotene (8.8-10 mg/100 g), good cooking quality with a soft texture
13. Kalinga	105-110	17.2	2004	Spreading type, open pollinated selection, suitable for food and fodder, starch extraction, susceptible to sweet potato weevil
14. Goutam	105-110	18.9	2005	Spreading type, clonal selection, suitable for both <i>Kharif</i> and <i>Rabi</i> seasons, good cooking quality, tolerant to sweet potato weevil
15. Kishan	110-120	17	2005	Semi compact with greenish purple vine, suitable for food and fodder, high starch content, tolerant to mid-season drought, tolerant to sweet potato weevil
16. Sourin	105-110	16.2	2005	Spreading type, clonal selection, suitable for <i>Kharif</i> and <i>Rabi</i> seasons, tolerant to sweet potato weevil, withstand mid-season drought
17. Bhu Sona	105-110	20-24	2017	Dark orange with b carotene (13.2-14.4 mg/100g), good cooking quality, field tolerant to weevil (<10% infestation), suitable for processing
18. Bhu Kanti	105-110	22-24	2017	Orange fleshed (b carotene 6.2-7.8 mg/100 g), good cooking quality, tolerant to mid-season drought and salt stress
19. Bhu Krishna	100-120	18-22	2017	Anthocyanin rich variety (85-90 mg/100 g), highly tolerant to weevil (<5% incidence) and salt, suitable for processing
20. Bhu Ja	100-110	20-22	2017	Orange fleshed with b carotene (5.5-6.4 mg/100 g), good cooking quality, tolerant to salt stress
21. Bhu Swami	105-110	20-24	2017	Tuber with white skin and white flesh, excellent cooking quality, tolerant to mid-season drought, suitable for food and processing, tolerant to weevil



Serthlum rawng Kawlbahra variety te:

ICAR-Central Tuber Crops Research Institute (ICAR-CTCRI), Thiruvananthapuram leh Bhubaneswar, Odisha-a Regional Center te chuan variety siam danglam (biofortification) hna an thawk a, Serthlum rawng (orange fleshed) chi hrang paruk - Bhu Sona, Sree Kanaka, Bhu Kanti, Bhu te chu tihchhuah a ni tawh a, Ja, Gouri leh Sree Rethna te an siam chhuak a ni.

Heng variety chi hrang hrang zing ah hian Sree Rethna bik ah Beta (β)-Carotene awm zat chu 3.2 - 3.5 mg/100g a awm a, Bhu Sona variety ah chuan carotene 11.5 - 12.5 mg/100g inkar a awm bawk.



Planting material siam chhuah dan

Nursery buatsaih dan :

Kawlbahra tih pun nan chuan a kuang tan chhum (vine cutting) hi hman ber a ni a, nursery atanga a kuang tan chhum te chu hrisel tak an ni tur a ni. A tih pun nana a bal (tuber) hman a nih chuan primary leh secondary nursery siam ngei ngei tur a ni.

Primary nursery:

Nursery chu huan a phun hma thla thum a la awm in siam tur a ni a. Ram hectare khat (Buh tin hnih leh chanve) hmuna phun tur chuan primary area 100 m² leh medium size bal (tuaingawt ei chhiat loh) 100 kg (125-150 g a rit) a phun theih a. Lei chhun vum (ridge) 60 cm inkar siam in, lei chhun vum (ridge) ah chuan 20 cm inkar pdan zel ah bal (tuber) chi tha ho chu phun tur a ni.. Tui tlakchhamna hmuna chuan tubers chu a in dawt te te (row) a phun mai tur a ni. A kuang sih chhum te chu a lo than chak theih nan a phun atanga ni 15 inkar dan ah urea 1.5 kg / 100 m² hmangin spray thin tur a ni. Nursery te chu a tul hun apiangin tui pek thin tur a ni a. Ni 45 atanga ni 50 hnuah secondary nursery a phun tur in a kuang chu 20cm atanga 30cm ah tan chhum (cut) leh tur a ni bawk.

Secondary nursery:

Primary nursery atanga a kuang (vine) tan chhum te chu secondary nursery 500 m² a zau ah tihpun leh tur a ni a, ram hectare khat a zau a phun theih tur in tihpun zel tur a ni. Bawngkek, ar-ek etc. te 1 m² a zau ah

kg 1 zel hman tur a ni a, 60 cm inkar dan zel ah lei chhun vum (ridge) siam tur a ni. Primary nursery atanga a tang tan chhum te kha secondary nursery ah 20 cm inkar dan zel ah phun mai tur a ni. A lo than that theih nan urea kg 5 zel hman hnih ah then sawm in phun atanga ni 15 leh ni 30 hnu ah kah (spray) leh mai tur. Phun atanga ni 3 chhung chu regular tak a tui pek tur a ni a, chumi hnuah ah ni khat dan zel ah kar khat chhung tui pek thin tur a ni. Ni 45 hnu ah huan (main field) a phun turin kawlbahra kuang chu 20-30cm a sei a tan leh mai tur.

Huan a phun tur a chi tha thlan dan:

Secondary nursery ah ni 45 -50 chhung an awm hnuah, a lai (middle) leh a chung lam (top) atanga 20 cm atanga 30 cm vela sei cutting chu huan a phun theih tur in buatsaih tur a ni a.

A kuang (vine) tan chhum kha phun hma ni 2 vel chhung chu dai him ah dah tur a ni a, hei hian zung tha tak a kaih theih nan a puib bak ah tam tak thar chhuah theih nan a puib bawk. Hmun hla tak a phurh chhuah a nih dawn chuan a kuang hnah la awm te kha pah tur a ni a, hei hian a rit lutuk tur a ti ziaawm thin a ni.



Planting materials of sweet potato

Phun na tur huan/ram siam dan (Land preparation)

Kan phun na tur huan chu 20 cm vel a thuk in lai/chch phut tur a ni a. A tlangpuiin kawlbahra chin dawn chuan lei chhun vum (mounds, ridge leh furrows) leh khawih danglam loh (flat bed) method te hi hman a ni a. Sweet potato hi Tui luan chhua zung zung theih loh na leh ram tlem a awi deuh (sloppy) hmuna heng method hrang hrang te hi an hmang uar ber a ni. Lei chhun vum (ridge) a phun a nih chuan 90 cm a inhlat, a san zawng 45 cm hi duhtusam a ni.

Lei chhun vum (ridge) a kawlbahra phun thatna te:

1. Lei luang ral tur a veng thei
2. Ei chhetu rannung te enkawl a awlsam phah
3. A bal cho chhuah a awlsam
4. A bal to diklo tur a ti tlem
5. A bal (tuber) size a lian tlangpui
6. A quality a tha hlc bawk

Ram buatsaih leh phun dan:

Kan phun na tur lei chu tha tak in chch/laih phut vek tur a ni a. 60 cm inkar ah 25-30 cm a sang tur lei chhun vum (ridge) siam tur a ni a, cuttings te chu lei ah 60 x 20 cm inkar dan zel ah phun tur a ni.

A phun hun:

Ruahtui in a chawm (rainfed) tur chuan ruahtui tlak tan tir ah phun a tha ber a, an lo puitling hma thin a ni.

A phun/chin dan

Cutting (a tang tan chhum) chu tlang khatah (per hill) pahnih zel phun tur a ni, 20 cm inkar dan zel ah phun mai tur a ni. Ruuahsur loh lai a phun a nih chuan kan phun zawh velch tui pek ngei ngei tur a ni a, phun atanga ni 10 chhung chu a to that theih nan regular deuh a tui pek tur a ni. Lei tha pek dan: Lei tha (bawng ek, ar ek etc.) te chu hectare khat hmuna ah ton 5 zel phun hman lei nen chawhpawh tur a ni a, urea, SSP, MOP te pawh hectare khat hmuna ah 50:25:50 kg zel hman bawk tur. (Hectare khat hmuna ah urea (55 kg) emaw ammonium sulphate (125 kg), rock phosphate (125 kg) leh muriate of potash (85 kg) te chu a phun laiin hman tur. Phun a tanga ni 30 hnu ah 55 kg urea emaw 125 kg ammonium sulphate te chu kah (spray) thin tur a ni a, hei bak ah hian lei rih vur (carthing up) tih ngei ngei a ngai bawk. Tui pek dan: Thlai te kha an lo than that nan ni 4 atanga ni 5 chhung chu a hnaung deuh reng tur a ni a. Phun atanga ni 8 leh ni 20 inkar hi a bal insaim chhoh hun lai anih vang in lei kha hnaung (moist) reng a dah tur a ni.