

Asian and Pacific Workshop on Whole-Process Mechanization of Potato Production

MECHANIZATION OF SWEET POTATO PRODUCTION IN MALAYSIA

Dr Md Akhir bin Hamid
Engineering research centre
Malaysian Research and Development Institute (MARDI).
MALAYSIA
mdakhir@mardi.gov.my

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Content over view

- Introduction
- Status of mechanization sweet potato production
- Challenges and constraints faced for whole-process mechanization of sweet potato production
- Suggestions for regional cooperation for whole-process mechanization of potato production in Asia and the Pacific
- Conclusion

INTRODUCTION

- **Sweet potato is becoming 6th or 7th most produced food crop in the world.**
- **The largest cultivated area is China about 3.5 mil. Hac- 43% of total production in the World**
- **Its growth well on many type of soils and its special crops**
- **In Malaysia the total area cultivated was 1309 hac. in 2009 and Increase to 2505hac in 2013.**

Top ten sweet potato producing country in the world

Country	Production	
	Area (hectares)	Volume (Tons)
China	3,524,505	79,090,068
Nigeria	1,115,000	3,400,000
Tanzania	675,000	3,100,000
Uganda	550,000	2,587,000
Indonesia	161,850	2,386,729
Vietnam	135,900	1,364,000
Rwanda	112,346	1,081,224
India	111,800	1,132,400
United States of America	45,810	1,124,230
Ethiopia	39,076	1,354,911
Total top ten	6,471,287	96,620,562
World	8,240,969	110,746,162

AREA PLANTED(HA) WITH TUBER CROPS IN MALAYSIA (Ministry Agricultural Malaysia 2013)

Areas and yield sweet potato production as compare to other tuber crops

Year	Cassava (ha)	Cassava (mt)	Sweet potato (ha)	Sweet potato (mt)	Coco yam (ha)	Coco yam (mt)
2009	3,075	68,508	1,309	13,495	656	6,366
2010	2,708	37,183	2,176	23,054	348	2,887
2011	2,596	33,206	2,229	26,582	385	2,802
2012	3,053	40,998	2,386	25,417	384	3,183
2013	3,205	43,048	2,505	26,688	403	3,342

Sweet Potato Growing Area

- **Major growing area:**
 - on tin-tailing (in rotation with yam-bean in Perak)- **91,000 Hac**
 - drained peat (in Selangor and Johor)- **870,000 hac**
 - Bris sandy soil (alternative crops replacing tobacco farm in Kelantan)- **165,000 Hac**
 - on paddy land (as in the off-season in single crop area in Kedah).- **433,000 hac**
- **Sweet potato has an advantage over cassava – less competition from more lucrative crops.**
- **AFTA implemented in 2010- sweet potato is one of alternative crops replacing tobacco**

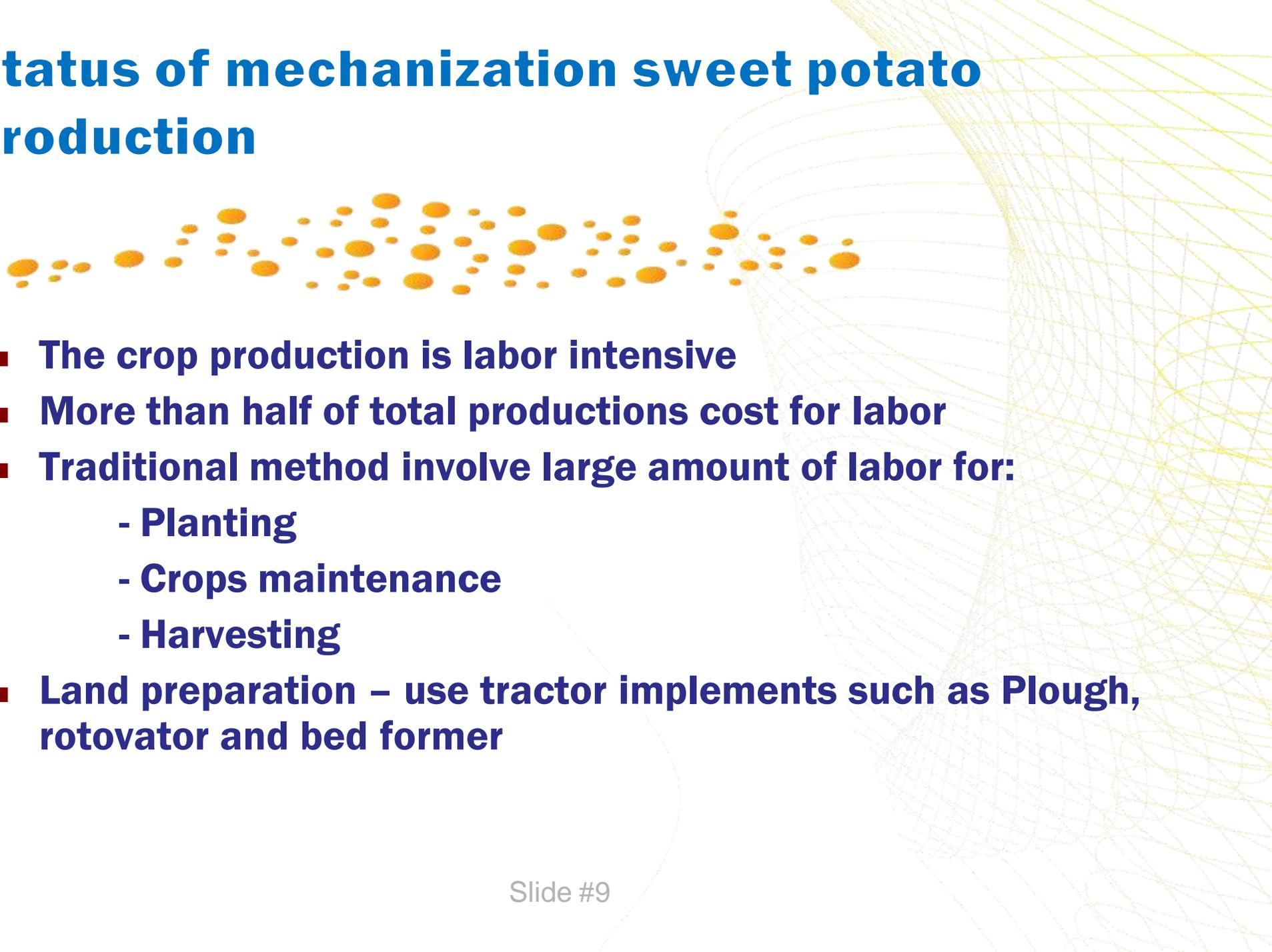
Sweet potato Marketing

- Currently no major industry to absorb the sweet potato supply – Price very unstable.
- Sweet potato prices:
 - US\$, 0.10 to US\$ 0.27 kg tubers at the farm gate
 - Depending on the variety-orange/purple flesh high price
 - Time of the year-higher prices are encountered yearly during fasting month.
- The middlemen are responsible for transporting the tubers to the wholesale markets in the cities.
- Farmers sell their product directly in weekly farmer markets as known as pasar tani (manage by FAMA) thus bypassing the middleman.

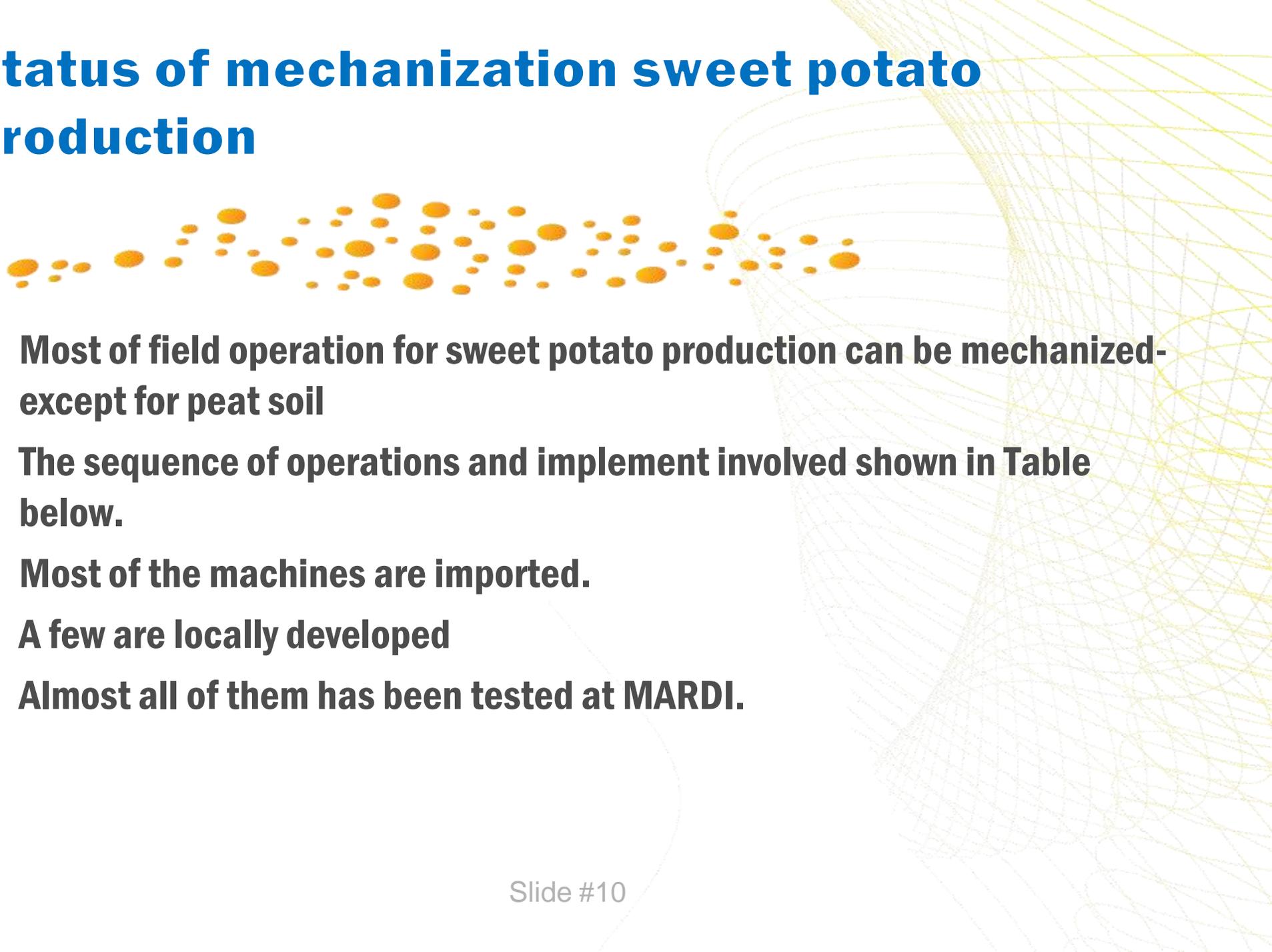
Sweet Potato Utilizations

- **Sweet potato is sold fresh use with no major processing industry**
- **Except for small-scale production of traditional snacks such as kerepek (crisp), and cakar ayam or as a filler in Chinese pastries, such as moon-cakes during the Mid-Autumn festival.**
- **This dependence on the fresh market limits the production of sweet potato, leading to drastic drops in price when production is expended suddenly**

Status of mechanization sweet potato production

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- **The crop production is labor intensive**
 - **More than half of total productions cost for labor**
 - **Traditional method involve large amount of labor for:**
 - **Planting**
 - **Crops maintenance**
 - **Harvesting**
 - **Land preparation – use tractor implements such as Plough, rotovator and bed former**

Status of mechanization sweet potato production

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- **Most of field operation for sweet potato production can be mechanized- except for peat soil**
 - **The sequence of operations and implement involved shown in Table below.**
 - **Most of the machines are imported.**
 - **A few are locally developed**
 - **Almost all of them has been tested at MARDI.**

Machinery operation, availability, problems and requirements for sweet potato production on bris and tin-tailings soils

Machinery available for sweet potato cultivation

Operation	Machine requirement	Availability
1. Land Preparation		
a. Tillage (rotor)	Rotovator	Suitable on <i>bris</i> soil, attached to a 30 hp 4 w tractor. Setting for ridger 1 016 mm for tractor operation.
b. Rotor + Ridger	Rotovator + ridger	
2. Planting		
a. Planting materials	Mechanical aid	cuttings 300 mm long, short internode, 8 nodes per cutting.
b. Planting spacing	1 016 x 240 mm , 40 000 plants/ha	
c. Planting method	Transplanter attached to a 30 hp 4 w tractor, planting on beds, 1.3 m wide.	
3. Fertilizer applications		
a. NPK (granular/ powder)	Spreader with some modifications	Available
b. Organic fertilizer (dry and granular/powder)	Spreader with some modifications	Modified, suitable for dry applications

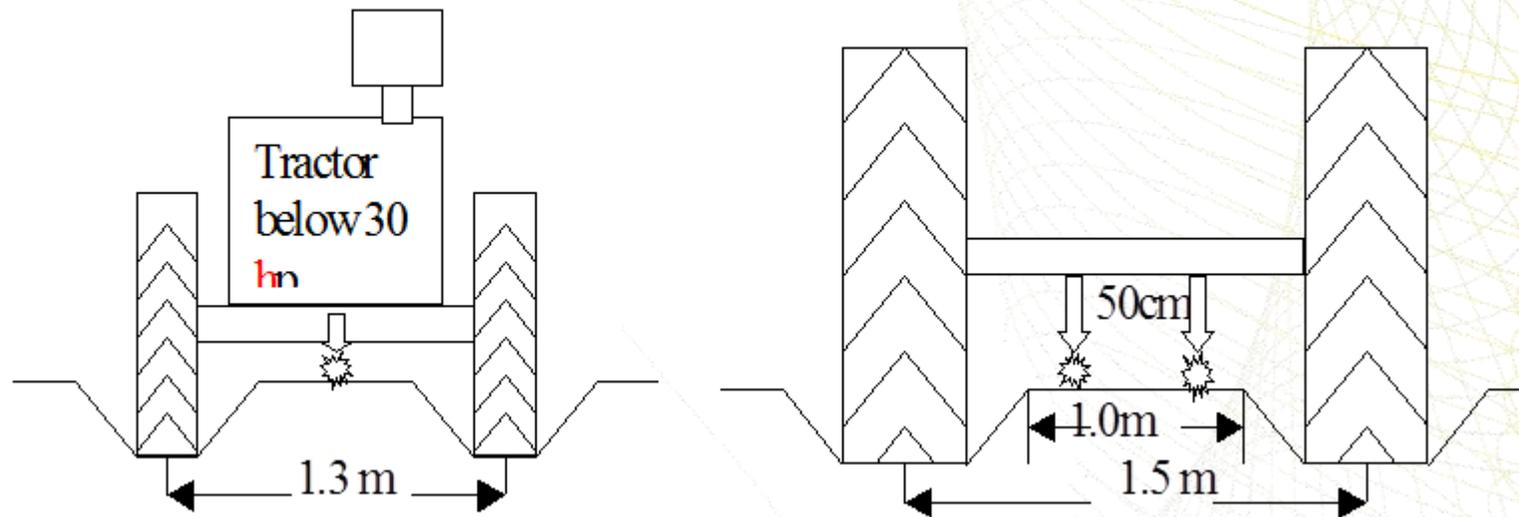
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Operation	Machine requirement	Availability
4. Pesticide spraying	Boom sprayer attached to a 30 hp, 4 WD tractor.	Available, tractor tracks follow the furrows during sprayer.
5. Water management		
a. Irrigation	Any type of sprinkler available, depending on field conditions	Available
b. Drainage	Ridger or disk furrow	Available
6. Harvesting		
a. Vine slashing	slasher or bale roller	Needs some modifications
b. Root digger	<ul style="list-style-type: none"> - Vibrator digger - Modified Houlton destroyer digger - Some use of plough/mechanical implements but damage is high. Trailer attached to a tractor and manual collection	Still under research/ manual collector is still needed
c. Root collection		Available

Land preparation at bris and tin tailing soil



Landscape planning for mechanize sweet potato production



Single and double Planter



Machines for Crops maintenance



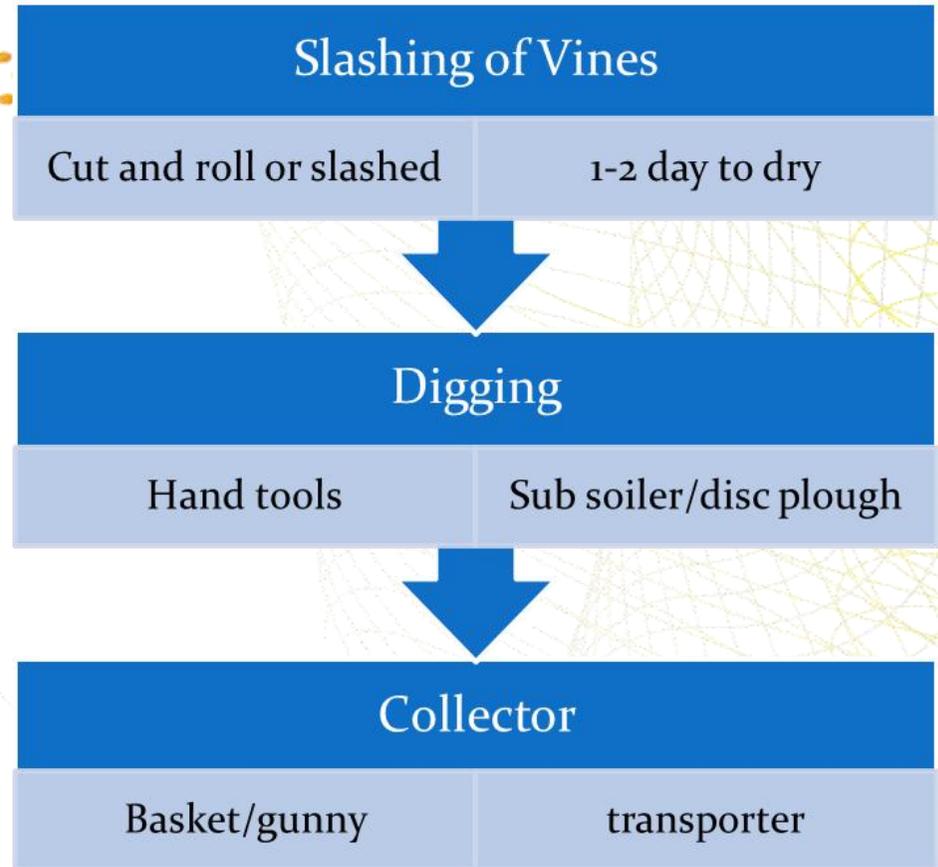
Manual harvesting



Sub soiler



slasher



Mechanize Harvesting



Estimated costs (US\$) for manually and mechanically sweet potato production

Description	Manual productions			Mechanical Operation
	Mineral soil	Sandy soil	Drain peat	Sandy soil
Land preparation	240	160	160	160
Planting	176	176	176	128
Crop maintenance	582	1424	572	1014
Harvesting	264	264	264	144
Total costs	1262	1924	1172	1566
Cost per kg Tubers	0.064	0.096	0.059	0.078

- Machinery system in sandy soil savings US\$ 400 per hectare, compared to a manual : Yield of 20 tonnes/ha (US\$ 0.02/kg).

Working rate in the manually and mechanically operations for sweet potato production on bris soils

Operation	Traditional		Mechanized	
	Method	Man-hours/ha	Method	Hours/ha
1. Ploughing		-		-
2. Rotor tilling		-		-
3. Rotor tilling/ ridging		2.5		2.5
4. Cutting vines				
5. Planting	Hand tool		Hand tool	
6. Fertilizer	Manual with tool	60-67	Planter, Spreader	60-67
7. Irrigation	Manual	150-160	(row)	6-8
8. Weeding	Manual,	40	Sprinkler	2-3
9. Pesticide application	Manual with tool Knapsack sprayer	50 60	Inter-row weeder Boom sprayer	2-2.5
10. Harvesting:		60		2-2.5
Vine slashing	Manual with tool		Rotor slasher	2
Root digging	Manual with tool		Digger-collector	
Root collection	Manual	16		2-2.5
		}		}
		} 352		} 6-10
Total		795-813		96-112

Challenges and constraints faced for whole-process mechanization of sweet potato production



- 1. Machinery for sweet potato production is expensive and farmer not entitle to buy.
- 2. Machinerics for tuber crop cannot be used in wet soil condition raining season.
- 3. Facilities and resources for the purpose of machinerics training is incomplete
- 4. The lack of skilled trainer for training

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- 5. The recognition of trainer standards are not uniform
- 6. The lack of skilled labour in agriculture mechanization and automation
- 7. Limited transfer of technology
- 8. Young generation are not interested in agriculture
- 9. Farmers area is small between 1- 2 hac, not suitable to own machinery

Suggestions for regional cooperation for whole-process mechanization of potato production in Asia and the Pacific

- Scaled labour can be developed through training courses for field machineries handling. In this regard, any member of Asia and the Pacific had technology to give training courses to the service provider, farmer or entrepreneur for mechanised in field production of sweet potato.
- The machineries training and courses can give benefit to the workers to handle field machineries for sweet potato production. It also can extract the young people work in agriculture by using machine. This should have training courses to the young farmers and agriculture Agency to supervisor of Agriculture machinery.

Conclusion.

- A complete machinery system based on a standard four – wheeled tractor has been developed and tested for mechanized commercial sweet potato production
- Almost all field operations in the production of sweet potato can be mechanized.
- Mechanized production can save a substantial amount of labour and costs of field operations
- Mechanized production involves a large amount of capital,
- Carefully planning is needed for machinery optimum used in the field.

Asian and Pacific Workshop on Whole-Process Mechanization of Potato Production

Thank you

Dr. Md Akhir bin Hamid
Engineering research centre
Malaysian Research and Development Institute
(MARDI), Persiaran MARDI-UPM,
43400 Serdang , Selangor.
MALAYSIA
Tel: 603-8953 4765
mdakhir@mardi.gov.my

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