

Appendix 1

Project Proposal

To

Establish a Cell Tray Nursery in Jordan for the BRP-CAP

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Background

Techniques currently being used in Ministry of Agriculture nurseries (Jordan) although successful are inappropriate for the new requirements of the BRP-CAP. This is because there has been a quantum increase in the numbers of plants needed for the project and a fixed budget to achieve this. A huge logistics problem exists because of the present system of using planting containers of around 2 litre capacity often weighing more than 3kg.

A "Cell Tray" system has been developed in Australia over the past 20 years. This system very efficiently addresses the issue of growing, transporting and planting of very large numbers of seedlings to the plantations.

This proposal is to replicate such a system for a nursery in Jordan to supply seedlings for the BRP-CAP project. It outlines the requirements to do this for the construction of a nursery with a 1 million seedling capacity.

Justification

Substantial cost savings can be made in many areas within the nursery compared to the present system once the initial cost of setting this up has been done.

Three prime areas where these savings can be made are:

- Potting mix. Although the cell trays require a relatively expensive mixture of peat moss and perlite, only 3% of the total quantity of media is required. For 1 million bags, about 2000 m³ (approximately 2000 to 3200 tons) of media is required whereas with the cell trays only 80 m³ (approximately 10 – 20 tons) will be needed. Cost of soil for bags is JOD18,000 compared to peat/perlite mix for cells JOD4920.
- Transport of seedlings to the plantation sites. To transport 1 million shrubs in bags, 530 trucks will be needed. Using shelving and the lightweight cell trays only 12 trucks would be needed. Based on one truck journey costing JOD200, the annual saving would be more than JOD100,000.

- A huge indirect saving is gained using plugs as it allows for mechanical sowing rather than hand sowing. My assessment of the labor cost for sowing 1 million shrubs would be JOD 200,000. This is based on observations of contract planting rate at Osagih East in Jan 2014 (1 man day = 100 shrubs planted). In comparison mechanical planting using Chatfield's tree planters from Australia (sowing rate 8,000 shrubs/day), the labor cost would be JOD10,000.
- The overall cost saving each year with using the cell system compared to the bags for these 3 areas alone will be JOD303,000

There are various other benefits and savings to be had once a modern nursery is established. These include:

- cell trays are good for at least 20 years use (save on annual purchase of bags and pots and eliminate plastic waste problem in the field);
- big benefit with manual handling for nursery workers as trays are light and waist high benches make all activities better from an occupational health and safety (OHS) perspective;
- best possible growth of seedlings with nutrition, hygiene, water regulation, pest and disease control all part of normal operations;
- vastly reduced volume and weight with potting media means less work and OSH risk to employees; seed sowing can be done by a reasonably simple machine which has a capacity of 120,000 cells per day;
- overall water saving with smaller nursery area needed and modern efficient irrigation;
- ability to grow a second crop in one year as the season for the shrub plantations crop will be only about 5 months (October – February).

With a nursery such as this cell tray system, Jordan could lead the region in shrub production technology.

Recommendations

The pre-requisite for this nursery will be a site that has an adequate water supply (min 70 m³/day) of quality water (Ec < 1000ppm) and a reliable power supply (min 25KVA). Around 3 hectares of flat land will be adequate and a perimeter security fence will be required. The main nursery production area should have either a concrete floor or at least a crushed stone over a limestone base. The specific requirements for this nursery are attached (**Attachment 1**).

Observations from the cell tray experiments set up in February 2014 have indicated that the a better survival rate from the bigger (80cc) cell trays compared to the smaller (45cc) trays and so I recommend that these be the ones (80cc) we use in Jordan.

High benches are an integral part of this system and a modular system will be the most economic way of proceeding. Galvanized steel and aluminum components are pre-cut and then assembled on site using "Tek" screws. All requirements for benching are included in **Attachment 2**.



Figure 1: Current nursery system (Khaldiyyah – Jordan)



Figure 2: Current cell tray nursery system (Western Australia)



Figure 3: Transport of seedlings in cell tray systems (Western Australia - The truck load contains approximately 300,000 seedlings)

CHATFIELDS
TAMMIN WESTERN AUSTRALIA
Original "One Pass" Tree Planter

Original Planter \$38500 plus GST (if applicable)
Direct seeder module \$5500 plus GST (if applicable)

The image is a promotional graphic for Chatfields. It features a yellow background. At the top is a logo with a stylized green tree icon above the word 'CHATFIELDS' in large, bold, brown letters. Below this, it says 'TAMMIN WESTERN AUSTRALIA' in green and 'Original "One Pass" Tree Planter' in bold black. In the center is a photograph of a yellow tractor-mounted planting machine. At the bottom, there is pricing information: 'Original Planter \$38500 plus GST (if applicable)' and 'Direct seeder module \$5500 plus GST (if applicable)'.

Figure 4: Chatfields planting machine (Western Australia)



Figure 5: Seed sowing machine in cell tray (Western Australia)

Disadvantages of the Cell Tray System

Growing plants in very small containers has one major disadvantage over a larger bag or pot system. This is that they are much less forgiving than big plastic bags of any condition which puts the plant under stress.

- This applies mostly to moisture stress. It is of paramount importance to monitor the moisture levels on a continuous basis and apply the correct amount of water at the correct time.
- Nutrition is also vitally important with seedling plugs. Measured amounts of fertilizer must be applied usually in liquid form through the irrigation system.

Preliminary testing of Cell Tray System in Jordan: 6

Cell trays representing 2 sizes (72 cell tray with 45cc cells and 81 cell tray with 80cc cells) were planted with saltbush (*Atriplex halimus*) in early February at 4 MoA nurseries. These nurseries were Khaldiyyah, Deyr Alla, Al-Basah, and Ghor-al-Safi. All nurseries experienced a fair degree of success with good growth of plants in some cells. At the same time, all nurseries experienced some seedling loss, generally because of watering issues (both too little and too much). It is very encouraging to see the system beginning to work and the staff in the nurseries embracing the new idea.



Figure 6: *Atriplex* seedlings growing in a cell tray (Ghor-al Safi 23rd Mar 2014)

Study Tour in Western Australia ?

Cell tray system nurseries in Western Australia are in peak production phase at present (March) and will be until plants are sent out to rehabilitation areas and plantations in June and July when winter in the southern hemisphere . This would



be an ideal time for a delegation to come to Australia and see these nurseries in operation. In addition the shrub planting machines can be seen and a demonstration of their operation can be arranged. Plantations can be visited also. I will be very happy to host such a group. Having spent 32 years with the Department of Agriculture in Western Australia I have many contacts and so viewing of any other areas of particular interest to delegates can also be arranged.

Community Involvement

The massive numbers of shrubs to be sown into plantations on the Badia (11,750,000 by 2019) and the very tight budget (about US\$0.45 per shrub) necessitates the use of mechanization. Even with maximum use of machinery, this operation is still very labor intensive. Many workers from local communities are still required at all stages of the process. Once communities have been identified, seedlings from main (primary) nurseries can be sent to them after the 6 week stage to be grown in local (secondary) nurseries until mature (4-6 months). At transplantation time, small and lightweight plugs mean communities can handle and transport to site with ease.

Nursery Location

The ideal location for the Primary Nursery will be somewhere in the Jordan Valley. Conditions here will mean seed can be planted in late August – early September, grown over a warm and mild winter and then transferred to the Badia in January- February when climate and moisture conditions are most favorable for plant survival.



Figure 7: Field plantation planting and watering (Osaghi East, Safawi region, Jan 2014)

A Stand Alone Primary Nursery Commercial Contract?

Building a cell tray primary nursery in Jordan and bringing into full operation successfully is a very specialized task requiring specific skills and knowledge gained from many years of experience. As my contract with UNOPS is expiring on May 31st 2014, I may not be present to help establish this facility in Jordan. I have made some preliminary investigations and there may be a chance of securing some international funding to contribute to the cost of establishing a Nursery as a “Turn-key” project in Jordan. That is, if a suitable site with appropriate water and power can be supplied, an expert Australian team can procure the materials and equipment under a commercial contract and build the new nursery to an international standard. Training of staff and bringing the operation into full production can be included.

I am convinced that this will give the BRP-CAP project a considerable boost to produce the necessary amount of high quality shrub seedlings for timely field plantation in the Badia and the necessary means to successfully achieve the project goals.

Attachment 1

Requirements for Primary Nursery Jordan

(Capacity 1 million shrubs per year)

Item	Source	Cost (approx in \$US)	Notes
Minimum 3 hectares flat land with a 2m security fence around the perimeter	Jordan		Available MoA
Clean, reliable water source (70 m ³ supply per day, maximum salinity 1000ppm)	Jordan		Available MoA
Workforce - will require 2 full time and 20 part time workers	Jordan		Available MoA
Accommodation for full time manager	Jordan		Available MoA
Accommodation for workers	Jordan		Available MoA
Power supply - 240V 25KVA	Jordan		Available MoA
Water tanks – 5 x 35 m ³	Jordan		Available MoA
Potting shed 400m ²	Jordan	\$15,000	
Tunnel houses – 2 required	Jordan	\$7,062	
One Automatic seedling tray filling machine	Australia	\$20,000	
One Automatic seeder	Australia	\$20,000	
Soil shed 30m x 10m.	Jordan	\$15,000	
10,000x 100 cell plastic seed trays	Australia	\$100,000	
26 Galvanized benches 3.6m x 23m x 950mm	Australia	\$50,000	Purchase pre-cut and assemble on site
Irrigation controller	Jordan	\$636	
Pumps – specs and price will depend on power	Jordan	\$3,000	
Shadecloth windbreak - 80% Green 3.5m x 400m 8 rolls	Jordan	\$2,260	
Shadecloth roof - 50% Green 14m x 70m 10 rolls	Jordan	\$2,824	
Galvanised Pipe for shade structure. 50 x 6m x 75mm x 2mm	Jordan	\$2,471	
Galvanised wire for shade structure. 150m x 12mm High tensile.	Jordan	\$1,694	

PVC pipe depending on pumps (estimate only)	Jordan	\$500	
PVC fittings depending on pumps (estimate only)	Jordan	\$300	
Front end loader - Teleloader 2.5 tonnes lift with forks and bucket	Jordan		Available MoA

Electric vehicle and trailers (Gator)			Available MoA
Forklift	Jordan		Available MoA
Chemical Shed – 20ft container is ideal for this purpose – could be purchased as part of shipment from Australia.	Jordan		Available MoA?
Office and Lunch room	Jordan		Available MoA
Toilets	Jordan		Available MoA
Concrete (or aggregate) for pathways (5,000m ²)	Jordan	\$98,000	
Diesel Generator (for emergency power) 25kw 240v	Jordan	\$9,165	Available MoA?
Solenoids irrigation valves 6 x 50mm	Jordan	\$507	
3mm solenoid wire (500m x 1mm x 6 core)	Jordan	\$140	
Sprinklers netafin micro x 400	Australia	\$2,400	
Soil bins (already included in soil shed)	Jordan	\$0	
Turnbuckles 10 x galvanized 16mm	Jordan	\$200	
Seed processing shed (40ft container) or demountable	Jordan		Available MoA ?
Fertilizer injection system – Dosatron	Australia	\$2,000	
Two desk Computers + printer / photocopier with WI-FI internet connection	Jordan		Available MoA
Flat bed truck - 8 tons	Jordan	\$70,000	
Racks for seedling tray transportation 8x	Jordan	\$14,000	
Agitator for mixing soil (Cement mixer type) 240 litre priced but large 5 m3 truck type preferred.	Jordan	\$4,237	
Poly Pipe (400m x 50mm high pressure)	Jordan	\$282	
Poly Pipe (800m x 25mm low pressure)	Jordan	\$225	
Poly Pipefittings	Jordan	\$200	
Tray sterilizing washer/tank and screens	Australia	\$25,000	
Thresher Kimseed (For seed extraction).	Australia	\$16,000	
Vacuum separator (seed cleaning) – can be deleted	Australia	\$0	
Screens 6 x 500mm	Australia	\$1,725	
Winnower seed cleaner – can be deleted	Australia	\$0	
Trolleys 4x	Jordan	\$10,169	
Tray poppers (for “popping” seedlings from trays)	Australia	\$4,000	
Air compressor 25cfm and fittings	Jordan		Available MoA

Air line	Jordan		Available MoA
Taps and hoses	Jordan	\$353	
Wheel barrows 20x	Jordan	1,400	
Fertilizer blending tank	Jordan		Available MoA
One utility vehicle and trailer for supply and pickup	Jordan	42,372	
Tools - Drill, Shovels, saws, cordless Tek-gun, welders etc.	Jordan	\$10,000	
Bag sewing machine for shade cloth	China	\$1,200	
Automatic weather station	Jordan		Available MoA
1 x 1500m roll of 3.2mm galvanized high tensile wire	Australia	\$150	
Tree planting Machine – 2 required and are essential for maximizing the benefits of plugs – Cost \$40,000 each	Australia		Not included in Nursery costing

Total US\$554,472
(=approximately JOD 393,675)

Factors which need to be considered when designing Nursery layout			
Weather conditions			
Rainfall and time of year			
Wind direction and speed - time of year			
Temperature - time of year			

Attachment 2
Cell Tray Nursery for Jordan
Benching Materials required for
for 26 Benches (cell tray capacity 1 million)

G 9858 Aluminum T Bar	3120 x 3200mm
Topspan 50	312 x 6100mm
1.2mm Stud	260 x 3200mm
1.2mm Stud	520 x 400mm
1.2mm Noggin	520 x 750mm
1.2mm Noggin	520 x 1200mm
32mm x 1.2mm Builders Strap	13 x 100 meters
10-16 x 16 WAF Teks Zinc alloy	10,400
12-24 x 20 Hex Teks no seal	650
10-16 x 16 Hex Teks no seal	5,200

These are the pre-cut raw materials required to construct 26 benches on site. Each bench can hold 480 trays (each tray is 81 cells) giving a total of 38,880 plants per bench. Twenty-six benches will hold 12,480 trays containing a total of approximately 1 010 880 shrubs seedlings. That would be sufficient to plant approximately 2020 ha (@ 500 shrubs/ha) on plantations sites in the Badia.