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COX'S BAZAR
FOOD SECURITY
SECTOR



Homestead Gardening Guidance Note

Vegetable production initiatives for household
consumption using minimal space in Rohingya Camps

Cox's Bazar Food Security Sector
June 2021

This guidance note was developed by the Cox's Bazar Food Security Sector (FSS), with technical support provided by Sector Lead Agencies: The Food and Agricultural Organization of the United Nations (FAO) and the United Nations World Food Programme (WFP). Technical review and verification with the Cox's Bazar Department of Agriculture Extension and the Refugee Relief & Repatriation Commissioner is ongoing.

Inputs and lessons learned from the following FSS implementing partners have been incorporated throughout – these inputs were collected via partners during FSS bi-weekly meetings, FSS gardening workshops, FSS partner field visits, partner reports, and consultations:

FAO, WFP, United Nations High Commissioner for Refugees (UNHCR), the United Nations International Organization for Migration (IOM), the United Nations Entity for Gender Equality and the Empowerment of Women (UN Women), Building Resources Across Communities (BRAC), HELVETAS, Solider Suisse, Solidarités International, Concern Worldwide (CWW), Social Assistance and Rehabilitation for the Physically Vulnerable (SARPV), SHUSHILAN, Center for Natural Resource Studies (CNRS), Danish Refugee Council (DRC), (Friends In Village Development Bangladesh (FIVDB), Gana Unnayan Kendra (GUK), MUKTI.

About the Food Security Sector

FSS is committed to saving lives through the coordination of appropriate, efficient, and well-resourced food security responses in major emergencies.

The FSS in Cox's Bazar was established in 2017 in response to the Rohingya crisis. The Sector is led by WFP and FAO and co-chaired by BRAC. Within the Inter-Sector Coordination Group (ISCG), the FSS is a platform to strengthen food security and livelihood response through operational coordination, information sharing and identifying food security related priorities and solutions. The FSS established the Livelihoods Working Group to strengthen coordination of livelihoods and self-reliance interventions to build resilience of Rohingya and host communities.



My Gardening

By Rohingya poet Ahtaram Shine

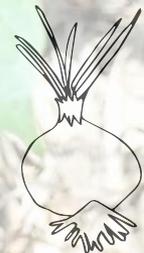
O gardening, you are my uniqueness,
an identity of the Rohingya's khet*
which always reminds of greenery.
Even if I am dwelling on the hillside,
I won't scrape you from my practice.
I pledge you to preserve from descending
like a skin spilt from the body.

If I could sow a seed,
I can imagine a tree
which may have a surface of shade.

As a gardener,
my tool is compost soil,
my favor is moist loam,
but my weapon is cow dung.
I can bullet it up if I have the sunlight.

Each soul is bliss
in praising the golden soil of Arakan.
Even a teila-zobin*
could bear zal moris*
with the efficacy of natural fertilizer
only by quenching their thirst with water!

Photo: IOM/Mustafa Kamal, bitter gourd, 2021



* *khet* means farm; *teila-zobin* is an area of high or hilly land; *zal moris* is chili pepper, a staple of Rohingya garden and foodways. Drawings have been digitized from original Rohingya embroidery art by Minara Begum, Hosne Ara, and Shamsunahar. For further information, please visit the [IOM Rohingya Cultural Memory Center](https://www.iom.int/rohingya-cultural-memory-center).

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Overview

With more than 880,000¹ people spread across approximately 25 sq. km. of single-story buildings, the Rohingya Refugee Camps are both the biggest and the most densely populated refugee camps in the world.² The camps sit on previously forested, now landslide prone topography. The decreased greenery due to deforestation has resulted in higher ambient temperature and slope destabilization. Since 2018, the humanitarian response, has engaged in camp greening activities, including the reforestation of 470 ha of land and engagement of nearly 60,000 HH annually in gardening initiatives. These camp greening efforts have both reduced the landslide risk within the camps and provided important disaster risk reduction programming and temperature control.³ The gardening initiative is also providing the Rohingya with vegetable production capacity at the household level which is supporting critical access to more nutritious and diverse diets. Furthermore, camp gardening supports greening efforts and decreases the demand of vegetables on the Cox's Bazar Market – a critical contribution given the anticipated 50-60% annual vegetable deficiency in Cox's Bazar District.⁴

Nearly three years after their arrival, the Rohingya continue to show high levels of vulnerability and remain heavily dependent on food assistance.⁵ The impact of COVID-19, and the subsequent lockdown efforts to quell the rate of transmission has further exacerbated levels of vulnerability in the camps. According to the [REVA 4 report](#), the acceptable food consumption scores in Rohingya households has decreased from 58% in 2019 to 50% in 2020, and without assistance more than 95% of the households would not be able to afford minimum expenditure basket (MEB). As access to nutritious foods remains an issue in the camps, distributing seeds and conducting trainings on vegetable gardening for household consumption can support in increasing access to nutritious diets. Furthermore, this initiative is in line with rural Bangladeshi practices of subsistence from household vegetable production.

Since 2018, more than 12 Food Security Sector (FSS) Partners have been engaged in camp gardening initiatives. The existing initiative includes components such as agricultural training and input distribution (i.e. seeds, sacks) and most of the FSS partners have introduced and implemented gardening activities using modern techniques, overcoming challenges such as limited space and water access. Gardening in camps also provides positive mental health benefits to Rohingya households involved, including the ultimate yield of fresh and healthy vegetables.⁶ As this activity enters into the 3rd year of implementation, FSS, in coordination with sector lead agencies, WFP, FAO, and relevant Government of Bangladesh line ministries, is striving to develop a 'living' harmonized guidance note on gardening activities in the camp for household consumption. This document builds upon three years of FSS partner experience and global recommendations in order to ensure continued strengthening and positive progression of gardening in the camps. It is the aim of this document to be regularly updated in correlation with increased lessons learned and changing camp dynamics – with the overall goal being to strengthen resilience and access to nutritious diets in the camps.

Objectives

1. **Improve household access to high quality nutritious food and dietary diversity in a refugee setting which is densely populated and stressed environment** – further increasing household resilience to meet their own nutritional needs

¹ Joint Government of Bangladesh – UNHCR, 2021, *Population Factsheet as of 31 March 2021*, [URL](#)

² Medecins Sans Frontieres, 2020, *COVID-19: Five challenges in Bangladesh and the Rohingya refugee camps*, Relief Web, [URL](#)
WFP, REVA IV, April 2021, [URL](#)

³ UNHCR, IUCN, 2019, *The Greening of Cox's Bazar - The Positive Impact of Liquefied Petroleum Gas (LPG) distribution among the Refugee and Host communities – Bangladesh*, Relief Web, [URL](#)

⁴ FAO, 2020, *Rapid Market Assessment on Vegetables, Fish and Livestock Value chain in Cox's Bazar*, [URL](#)

⁵ World Food Programme, 2021, *Refugee influx emergency vulnerability assessment (REVA) - Cox's Bazar*, [URL](#)

⁶ Concern Worldwide, 2021, *Upwards, sideways, sloped: gardening in refugee camps*, [URL](#)

2. **Enhance utilization of nutritious foods and support health and well-being of beneficiaries within the camps** – Studies indicate that involvement in gardening activities result in increased vegetable consumption, thus improving behaviour change towards healthy eating. Further, studies show that observing nature and participating in physical activity in green spaces, plays an important role in positively influencing health and wellbeing.⁷
3. **Provide capacity building opportunities** – teaches technical agricultural skills using minimal amounts of soil and water, while still increasing production. Further, gardening activities maintain heritage skills – many Rohingya were engaged in agricultural practices in Arakan, the connection between community and nature is believed to be passed on from their forefathers. For further information see [IOM Rohingya Cultural Memory Centre](#).
4. **Promote environmental and health benefits through camp greening** – Homestead gardening provides vegetation coverage which lowers ambient temperature, provides shade, increases moisture retention, improves soil fertility and reduces surface runoff – important factors in reducing soil erosion and improving the hydrological cycle within the camps. Further, lower ambient temperature correlates with positive health outcomes such as lower rates of non-communicable diseases.⁸
5. **Enhance local vegetable production in order to alleviate anticipated 50-60% annual vegetable deficiency in Cox's Bazar District (FAO 2020)** – this will further support [Bangladesh in reaching Sustainable Development Goal 2](#) through promoting sustainable agriculture in the camp setting which will work towards alleviating the current District-wide food deficit. ([2020, Md. Abul Kasem, Deputy Director, Department of Agricultural Extension](#))

Environmental/Geographical Context

The Rohingya influx placed enormous pressure on the environment and available natural resources in Cox's Bazar. Camps were established in protected forest areas, resulting in deforestation and disruptions to ecosystem services. In response, disaster risk reduction activities, including slope stabilization through the reforestation, were implemented. To compliment ongoing reforestation and slope stabilization activities, it is critical that homestead gardening efforts continue to work in parallel with such efforts. To this end, FSS and EETWG recommends partners to include the following key messages in homestead gardening activities:

Guidance for homestead gardening:

Guidance around plantation sites:

- Tree saplings are not to be removed, nor trees cut down, when cultivating vegetables.
- Avoid vegetable cultivation around 2019 and 2020 plantation sites.
- Ground vegetation conserves moisture and adds nutrients to the soil, therefore avoid removing it during vegetable gardening.
- New bamboo shoots and other grasses should not be removed for any purpose, especially as edible items.
- Consider crown canopy and the subsequent shade trees give when selecting the crop variety.
- Shade or trellis should not be erected for vegetable gardening over existing plantation sites as this will filter the sunlight.

Guidance in sloped areas:

- Consider pit and sack planting in areas prone to landslides to avoid destabilizing the slope.
- Vegetables with large leaves and vines should be considered as they can reduce splash erosion.
- Zero or less tillage is recommended for vegetable cultivation, especially in sloped areas and avoid cutting/damaging any steep slopes as this will become a landslide risk.

⁷ Garden Organic and Sustain, 2014, *The benefits of gardening and food growing for health and wellbeing* [Health Growing Food growing for health and wellbeing, URL](#)

⁸ Camp specific assessments are required to understand direct correlation between gardening, lower household temperature, and non-communicable diseases. Please see relevant research from other contexts [here](#), [here](#), [here](#), and [here](#)

Further, with the support from REACH Initiative, please see [ANNEX 2](#) for overview of landslide vulnerability. These maps should support partners in identifying landslide prone areas and identifying planting considerations accordingly. Landslide susceptibility is a higher priority consideration during monsoon season than in winter.

Seasonal Risks/Natural Hazards

Homestead gardening is directly impacted by natural calamities such as monsoon season or summer dry season and the availability of inputs with irrigation sources.

During the rainy season or continuous heavy rainfall, raising vegetables' seedlings is difficult. Additionally, high wind velocity damages the vegetative part of the plant, and fruits drop. Continuous rainfall (i.e. 3-7 days) can loosen surface soil and potentially lead to shattering of plants. Further, continuous rainfall can lead to flash floods which wash out surface soil and impacts bed plantation. All these risks decrease during winter cropping.

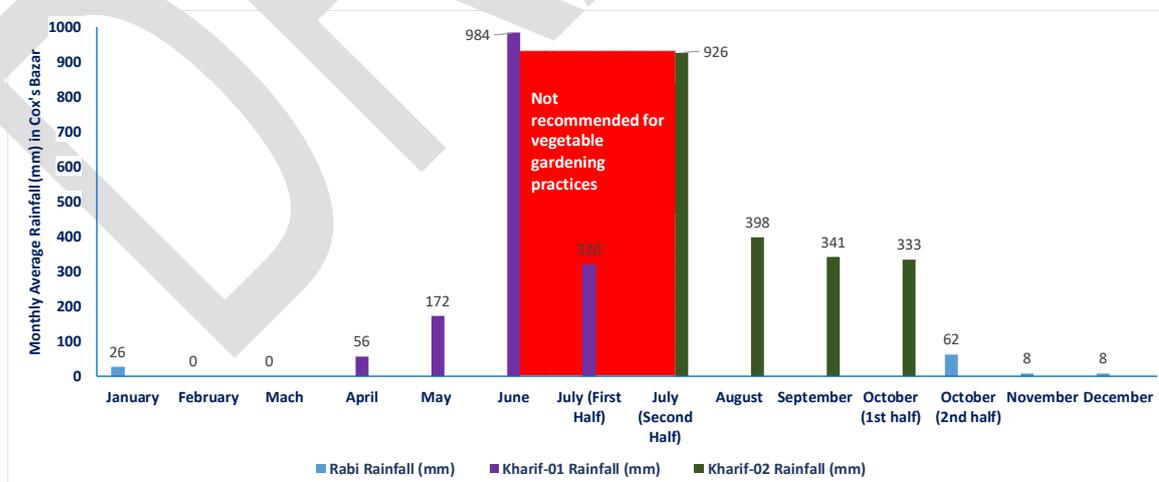
Some contagious pests and diseases (i.e. mosaic virus, aphids, fruit fly, etc.) may spread rapidly from one household to another in the dense plantation areas during the summer season. Further, due to scarcity of irrigation water in the summer season, some seedlings may be damaged or their growth may be slowed. The use of HH gray water can serve as both a pest control (phosphate levels in soap can reduce some insects) and alleviate water related stress during dry season.

The physical structures for production methods (i.e. trellis, vertical, multilayer, sack, roof, etc) may be damaged during high wind / cyclone season. Considerations for additional inputs to support and / or additional labor for the restoration of the damaged crops and repairing of the structures may be advised.

Based on assessing the risk in the camps, the following details the risks of gardening activities:

- i) Damage risk to gardening activities by continuing rainfall/heavy rainfall/storm/cyclone;
- ii) Risk of the landslide;
- iii) Soil erosion from surface soil due to bed plantation in the rainy season;
- iv) Pest & diseases attack and spread out due to dense households & plantation;
- v) Crisis of irrigation water during severe drought period – Kharif 1 season (March-May).

Figure 1: Rainfall pattern with different cropping seasons in Cox's Bazar



Source: Bangladesh Agriculture Research Council Website (2020); www.barc.gov.bd

Different production methods

Based on the recent FAO household gardening assessment in the Rohingya camps, below are six recommended production systems identified considering the camp contexts (i.e. space availability, species suitability, soil disturbance and water requirements) and the overall environment of the topographic areas (FAO, 2021). For production methods not included, partners are encouraged to submit assessment findings to FSS for consideration. In future iterations of gardening guidance, these assessments may be taken into consideration as additional production methods.

1. Bed Planting

- A piece of plain to mild slopy natural land with no above-ground structure.
- On higher alleviation to facilitate drainage and good access to sunlight.
- Requires soil tilling, depending on crop species selection.
- Mix compost and / or cow dung with soil and practice mulching for moisture conservation in reducing irrigation costs.
- Raised beds may be prepared and separated by a trench for proper drainage.
- Not suitable under highly stressed edaphic and non-edaphic environment
- Recommended seeds per cropping season are listed in the [crop species with reference yield](#) section.



Bed planting. ©FAO/Moksed Ali

2. Pit Planting

- Enclosed smaller separate beds sitting on with a full or partial basal connection to the land surface. Pit sides may be enclosed with a bamboo frame and bio-degradable polythene sheets
- Mix compost and / or cow dung with soil and practice mulching for moisture conservation in reducing irrigation costs.
- Suits stressed edaphic (such as soil salinity, hard and stony soil, and unfertile soil) and non-edaphic (such as waterlogging and water salinity) environments as it does not use natural land.
- Recommended seeds per cropping season are listed in the [crop species with reference yield](#) section.



Pit planting. ©FAO/Saimunnahar Ritu

3. Sack Planting

- Similar to pit planting except sacks are used as enclosure material, which do not have a direct attachment to the land surface, and the system is moveable.
- Mix compost and / or cow dung with soil and practice mulching for moisture conservation in reducing irrigation costs.
- The seeds will be sowed / seedlings will be planted on the soil surface and the sack will be placed at the homestead that is exposed to the sunlight and safe from waterlogging in the rainy season.
- Suits stressed edaphic and non-edaphic environments as it is not connected to natural land.
- Best usage for small rooted crops. Recommended seeds per cropping season are listed in the [crop species with reference yield](#) section.



Sack planting. ©FAO/Saimunnahar Ritu

4. Trellis Growing

- Similar to bed planting except a horizontal bamboo structure a bamboo framed structure will be erected around the pits or sacks that will later support the canopy of the creeping vegetables.
- Limits crop species choice as non-creeping crops experience a various degree of shadow from crops spreads on the above-ground structure.
- Mix compost and / or cow dung with soil and practice mulching moisture conservation in reducing irrigation costs.
- The use of pit planting or sac planting at the base can be adjusted depending on surrounding soil conditions.
- Recommended seeds per cropping season are listed in the [crop species with reference yield](#) section.



Trellis growing. ©FAO/Moksed Ali

5. Vertical Growing

- The vertical growing structure will be made with the support of bamboo poles and frame – the structure should be self-supported and secure and not rely on shelter structure.
- Structure placement and securment should consider wind direction/velocity.
- Mix compost and / or cow dung with soil and practice mulching for moisture conservation in reducing irrigation costs.
- The seeds will be sowed / seedlings will be planted on the soil surface and the sack will be placed at the homestead that is exposed to the sunlight and safe from waterlogging in the rainy season.
- Limits crop species choice as non-creeping crops experience a various degree of shadow from crops spreads on the above-ground structure.
- The use of pit planting or sac planting at the base can be adjusted depending on surrounding soil conditions.
- Recommended seeds per cropping season are listed in the [crop species with reference yield](#) section.



Vertical growing. ©FAO/Moksed Ali

6. Multilayer Growing

- Combination of a soil bed at the bottom layer, a bamboo framed structure (i.e. trellis) at the middle layer, and a nylon net spread horizontally as the upper layer above the trellis.
- Raised beds may be prepared and separated by a trench for proper drainage. May require soil tilling, depending on crop species selection.
- Mix compost and / or cow dung with soil and practice mulching for moisture conservation in reducing irrigation costs.
- Framed bamboo structure will support the canopy of the creeping vegetables on the middle and top layers of the structure.
- A nylon net can be spread onto the middle and top layers of the bamboo structure. The net will be tightened with the bamboo poles of the trellis and rope to protect from wind and support the weight of the vegetables.
- Up to three or four species of vegetable seeds can be sowed / seedlings will be planted considering vegetables that can grow in bed planting (bottom layer), creeping types of vegetable species on the trellis (middle layer) with heavy fruit weight, and light fruit weight on the upper layer.
- Not suitable under highly stressed edaphic and non-edaphic environment
- Recommended seeds per cropping season are listed in the [crop species with reference yield](#) section.



Multilayer growing. ©FAO/Moksed Ali

Crop species with reference yield

The appropriate crop species and methods are important in growing homestead vegetables in the Rohingya camps. The recent study (FAO, 2021) explored the suitability of vegetable crop species with six production systems. The crop species are recommended considering both the fruit and leaf for the diversity of the households' food habit/consumption, nutrition value, productivity, potential risks, soil types (i.e. clay and clay loam), organic matter content, and landscape.

Table 1: Recommended prioritized crop species for summer season

Sl.	Vegetable Species	Scientific Name	Production System	Ref. Yield (Kg/dec.)
1	Cucumber	<i>Cucumis sativus</i>	Sack, Pit, Trellis, Multilayer & Vertical growing	263-283
2	Bottle Gourd	<i>Lagenaria siceraria</i>	Sack, Pit, Trellis and Multilayer	223-243
3	Bitter Gourd	<i>Momordica charantia</i>	Sack, Pit, Trellis and Multilayer	85-93
4	Sweet Gourd	<i>Cucurbita Maxima</i>	Sack, Pit, Trellis and Multilayer	142-162
5	Ladies Finger	<i>Abelmoschus esculentus</i>	Sack, Pit and bed planting	69-85

Source: FAO field survey, 2021

Table 2: Recommended optional crop species for summer season

Sl.	Vegetable Species	Scientific Name	Production System	Ref. Yield (Kg/dec.)
1	Yard-long Bean	<i>Vigna unguiculata</i>	Sack, Pit, Trellis, Multilayer & Vertical growing	61-81
2	Eggplant	<i>Solanum melongena</i>	Sack, Pit and bed planting	162-182
3	Ash Gourd	<i>Benincasa hispida</i>	Sack, Pit, Trellis & Multilayer	100-120
4	Ridge Gourd	<i>Luffa acutangula</i>	Sack, Pit, Trellis & Multilayer	90-100
5	Indian Spinach	<i>Basella alba</i>	Sack, Pit, Trellis, Multilayer & Vertical growing	202-304

Source: FAO field survey, 2021

Table 3: Recommended prioritized crop species for winter season

Sl.	Vegetable Species	Scientific Name	Production System	Ref. Yield (Kg/dec.)
1	Country Bean	<i>Phaseolus vulgaris</i>	Sack, Pit, Trellis, Multilayer and Vertical growing	61-69
2	Bottle Gourd	<i>Lagenaria siceraria</i>	Sack, Pit, Trellis & Multilayer	223-243
3	Sweet Gourd	<i>Cucurbita Maxima</i>	Sack, Pit, Trellis & Multilayer	142-162
4	Tomato	<i>Solanum lycopersicum</i>	Sack and Pit, bed planting	324-344
5	Eggplant	<i>Solanum melongena</i>	Sack and Pit, bed planting	162-182

Source: FAO field survey, 2021

Table 4: Recommended optional crop species for winter season

Sl.	Vegetable Species	Scientific Name	Production System	Ref. Yield (Kg/dec.)
1	Radish	<i>Raphanus sativus</i>	Sack and Pit, bed planting	263-283
2	Red Amaranth	<i>Amaranthus cruentus</i>	Sack and Pit, bed planting	50-60

Source: FAO field survey, 2021

Inputs

The below is a general list of inputs based on partner feedback and recommended gardening types, this list should serve as guidance only – prioritization is given to the required inputs list. However, based on field observations, additional inputs may be strategic to include depending on production models.

Table 5: Required inputs for vegetable gardening

Type	Quantity	Size	Additional information
Buckets	2	20L	Partners are encouraged to look into recycling / repurposing opportunities for buckets
Sac	3	20L	Sacs may disintegrate, however further partner input on longevity is requested
Bamboo	8 (depending on gardening type)	Small and large pieces	Bamboo inputs are durable but considerations for regular maintenances should be made
Rope	N/A	--	Rope may require regular replacement due to wear and tear
Labour Cost	N/A	--	Required for installment of trellis and regular maintenance between seasons/storms, etc.
Additional Inputs			
Water can	1	6L	
Compost	10-20kg	--	Promotion of camp level composting can be linked with this initiative for circular model
Soil	10-20kg	--	Soil should be procured from flat areas, potential to connect with ongoing camp construction/ excavation projects
Bug net	N/A	--	Cost considerations to be assessed
Shovel	N/A	--	Cost considerations to be assessed

Source: FSS Partner Feedback and Field Visits

Pest Control and Disease Management

Pheromone Traps: Pheromones are chemicals insects use for communication. Insects send chemical signals to attract mates, warn others of predators, or find food. Pheromone traps can be used to monitor target pests. By monitoring for insects using these traps, early infestation detection may be possible – a critical step in lessening damage to agriculture or other plants.

Please see helpful video here: [Video training on "How to setup sex pheromone trap for insect control in vegetable garden" by HELVETAS Bangladesh and Shushilan](#)

Yellow Card: Yellow sticky cards are used as a form of pest control – the yellow colour attracts insects while the adhesive causes them to stick to the cards rather than be able to attack the plants. As with pheromone traps, yellow cards can be used to monitor insect type and prevalence and support in early infestation detection.

Please see helpful video here: [Video training on "How to use yellow card for insect control in vegetable garden" by HELVETAS Bangladesh and Shushilan](#)

Crop Calendar and Seasonal Considerations

The crop calendar is an important hand tool for the practitioners in practicing homestead gardening that provides the following guidelines in growing vegetables based on cropping seasons:

1. Indicate crop sowing and harvesting time in a crop calendar year;
2. Indicate production methods of homestead gardening;
3. Guide proper planning in the distribution of inputs (i.e. seeds and fertilizers);
4. Guide the field staff in growing year-round vegetables avoiding risks of damaging crops from heavy rainfall or cyclone;
5. Guide the field staff and practitioners in identifying lean periods and plan for early planting in mitigating risks of the natural hazards.

The following observations from the field may provide additional support:

Germinating seeds – Mature plant: Maintain protection from wind and high heat for newly planted seeds – this can be done through placing close to the home which may provide shading and wind protection. As the seeds grow, train them through attaching to trellis, to grow vertically. Eventually, once mature plant, the vines can grow on top of the house. This rotation of protecting germinating seeds and training mature plants to grow vertically correlates nicely with seasonal distributions (i.e. winter plants are mature and growing on the roof while summer seeds further mature, conversily, winter plants are likely dead by the time summer plants are mature enough to replace them on the roof).

Summer Season Limited Water Access: During the summer season, water access may be more limited. At this time, it is encouraged (and within current Rohingya Gardening Practices) to use 'second use' water. If possible, gardeners can form a gray water catchment within their homes to collect the water and recyle it through watering plants. Soapy water contains phosphate, which in moderation can be good for plants – it is recommended to prioritize watering plants in the early mornings and late evenings when it is cooler. Soapy water may also provide additional benefits such as insect control.

Figure 2: Crop Calendar for Vegetable Production in Rohingya Camp

Vegetable Species	Seasonal Distribution												Production System
	Jan	Feb	March	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Bottle Gourd													Sack, Pit, Trellis and Multilayer
Sweet Gourd													Sack, Pit, Trellis and Multilayer
Bitter Gourd													Sack, Pit, Trellis and Multilayer
Ridge Gourd													Sack, Pit, Trellis and Multilayer
Ash Gourd													Sack, Pit, Trellis and Multilayer
Cucumber													Sack, Pit, Trellis, Multilayer, vertical growing
Tomato													Sack, Pit and bed planting
Eggplant													Sack, Pit and bed planting
Country Bean													Sack, Pit, Trellis, Multilayer, vertical growing
Yard-long Bean													Sack, Pit, Trellis, Multilayer, vertical growing
Indian Spinach													Sack, Pit, Trellis, Multilayer, vertical growing
Ladies finger													Pit, Sack and bed planting
Radish													Pit, Sack and bed planting
Red Amaranth													Multilayer, Pit and bed planting

■ Sowing/Transplantation
■ Crop growing & harvesting
■ Risk from heavy rainfall

Kharif-01: 16 March - 15 July
 Kharif-02: 16 July - 15 October
 Rabi: 16 October - 15 March

Technically reviewed by: DAE, FAO, WFP/BRAC, January 2021
 Inputs distribution before 15 days of the distribution date for preparation

Cost analysis

Below are details related to input cost per household per activity. Please note, input costs should be considered indicative of total costs, it is estimated that there will be variability across agencies due to several factors such as: operational costs, organization size, input variation, and retailer variation. The below represents the six production methods from the 2021 FAO field survey – for production methods not included, partners are encouraged to submit assessment findings to FSS for consideration. In future iterations of gardening guidance, these assessments may be taken into consideration as additional production methods.

Table 6: Inputs costs per household

Vegetable production method	Inputs Types	Input cost per household (BDT)	Average land space per household (square feet) *	Species diversity per household*
Bed planting	Seeds, compost, bamboo, watering can, fencing, rope, and labor	1,600	61.3	3
Pit planting	Seeds, compost, bamboo, watering can, rope and labor	1,200	67.3	7
Sack planting	Seeds, sack, bamboo, compost, watering can, rope and labor	1,400	115.6	4
Trellis growing	Seeds, compost, bamboo (mul, borak), watering can, rope and labor	2,200	120.0	4
Vertical growing	Seeds, compost, bamboo (mul, borak), watering can, rope and labor	1,800	120.0	2
Multilayer growing	Seeds, compost, bamboo (mul, borak), watering can, net, rope and labour	2,800	166.8	4
Average		1,833	82.0	4

Source: FAO field survey, 2021

Comparative Standing of Six Homestead Vegetable Production Systems

FAO conducted a study having field level data collection support from the WFP, UNHCR, CWW and BRAC to observe vegetable production systems meeting year-round household consumption and nutrition in the Rohingya Refugee camps in Cox's Bazar, Bangladesh (FAO, 2021). The comparison study results on the six homestead vegetable production systems (HVPSs) are presented qualitatively in a 3 (system property class) x 3 (system property) matrix (Figure-1). Results indicate that larger variability occurred among the six HVPSs due to varying responses in system properties under the 'situational context' class. For example, bed and pit planting systems perform *excellently* in 'space friendliness' property, whereas sack planting, trellis growing, and vertical growing are *moderate*, and multilayer growing is *poor*.

The system properties under the 'value for money' class are less variable among the six HVPSs. Productivity is excellent under pit planting, sack planting, trellis growing and multilayer growing systems. On economic value, the four systems, except for pit planting and sack planting, are *excellent*; the latter two are *good*.

The variability among the six HVPSs on system properties under management perspective class is lower than situation context but higher than value for money class. Bed planting is *poor* for water economics, whereas sack planting is *excellent*. The rest of the proposed systems are *good* for water economics. Vegetable species grown under the six systems are largely suitable.

Figure 3: Performance matrix of six homestead gardening systems corresponding to their properties

System property class	System property	Production system						Score point (0 to 100 scale, relative to maximum performance of a system defined as 100)
		Bed planting	Pit planting	Sack planting	Trellis growing	Vertical growing	Multilayer growing	
Situational context	Space friendliness	●	●	●	●	●	●	<p>Score point (0 to 100 scale, relative to maximum performance of a system defined as 100)</p> <p>● Excellent (≥ 80%)</p> <p>● Good (≥ 60 - <80%)</p> <p>● Moderate (≥ 40 - <60%)</p> <p>● Poor (≥ 20 - <40%)</p> <p>● Extreme Poor (< 20%)</p>
	Species diversity	●	●	●	●	●	●	
	Environment friendliness	●	●	●	●	●	●	
Value for money	Productivity	●	●	●	●	●	●	
	Cost effectiveness	●	●	●	●	●	●	
	Economic value	●	●	●	●	●	●	
Management perspectives	Water economics	●	●	●	●	●	●	
	Species suitability	●	●	●	●	●	●	
	Easiness of adoption	●	●	●	●	●	●	

Source: FAO Homestead vegetable gardening assessment report 2021.

* Value for money is defined by the following: productivity⁹, cost effectiveness¹⁰, and economic value/coefficient.¹¹

Data Collection and Analysis

FSS recommends that partners engage in harmonized data collection where possible. Provided in the [ANNEX 1](#), is a sample questionnaire for post harvest data collection. Below are further details on recommended data collection and analysis. These are not requirements for partners – however, harmonized data collection will support in annual review and continued improvements.

- After seed and input distributions is completed it is recommended that partners conduct a post distribution monitoring (PDM) assessment. This assessment is recommended to be tailored to the specific implementing partner taking into consideration their unique projects.
- After each cropping season it is recommended that implementing partners collect information on post harvest yield. In the annex, is a sample tool that may be used. Door-to-door data collection of the households involved in this activity is recommended with a supervisor verifying at least 10-15% of the data collection on site for quality assurance.
- Where possible, partners are requested to share the findings from the above two suggested assessments with FSS. This information will be compiled and analysed in order to inform future project implementation such as cost analysis, seed types per season, and inputs.

Resources

- [Upwards, sideways, sloped: gardening in refugee camps – Concern Worldwide \(23 March 2021\)](#)
- [Video training on improved pit preparation by HELVETAS Bangladesh and Shushilan](#)
- [Video training on improved pit preparation using sack method by HELVETAS Bangladesh and Shushilan](#)

⁹ The productivity is defined as the 'bottle gourd equivalent yield (i.e. most commonly grown vegetable under almost all systems)' for a particular production system in a cropping season (i.e. summer or winter) in kilogram per square meter.

¹⁰ The production cost property will be computed as all variable costs (in BDT) per decimal (i.e. 432 square meters) in growing vegetables in a cropping season (i.e. winter or summer) for a particular production system.

¹¹ (1) This is measured as the ratio between the observed yield to the break-even yield. (2) Observed yield will be the average yield of all crop species grown in a particular production system per square meter area. (3) The breakeven yield will be computed as the production cost of all crop species grown in a particular production system per decimal (i.e. 432 square meters) area.

- [Video training on "How to use yellow card for insect control in vegetable garden" by HELVETAS Bangladesh and Shushilan](#)
- [Video training on "How to setup sex pheromone trap for insect control in vegetable garden" by HELVETAS Bangladesh and Shushilan](#)
- [Video training on 3G-4G technique to increase production by HELVETAS Bangladesh and Shushilan](#)
- [Early Warning Early Action Report on Food Security and Agriculture – FAO | March 2020](#)
- [IOM, FAO Micro Gardening Scheme to Help Feed Rohingya Refugees, Bangladeshi Local Communities | Release April 2021](#)
- [FSS gardening Planning Dashboard | February 2021](#)
- [Sustainable Development Goals Tracker – Bangladesh's Development Mirror](#)
- [Vegetable Production in Bangladesh: Commercialization and Rural Livelihoods](#)

Quotes

“It is better for us to grow vegetables from our house as we can use when we need, and it tastes fresher”
Camp 17, Male Gardener

“In the summer season, we struggle with less access to water and plants suffer. For this reason, we water our plants using ‘second use’ water from our kitchens, this allows the vegetables to continue to grow. Sometimes I also add neem to the water to prevent bugs”
Camp 17, Female Gardener

“I run a female headed household, this activity allows me to better feed my children vegetables without leaving my home. If I do not have support from NGOs, I will not have the means to continue gardening.”
Camp 17, Female Gardener

“I am very pleased for giving me the opportunity in practicing vegetable gardening that reduces my uncertainty on vegetable consumption.”
Camp 14, Female Gardener

“I was a skilled farmer in Myanmar and the homestead gardening work provided scope in growing vegetable at limited water and space for household’s consumption”
Camp 14, male gardener

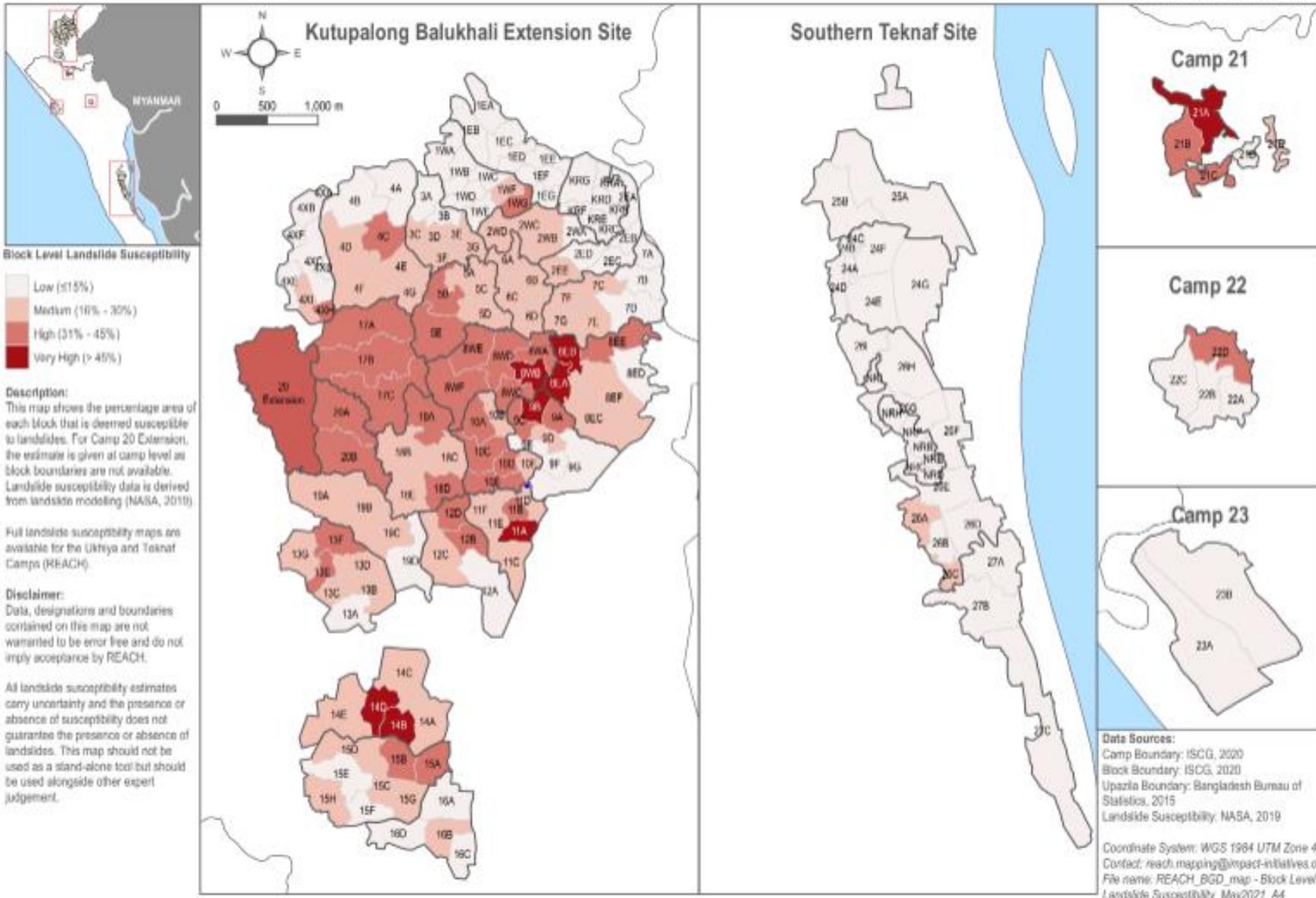
“I have grown sweet potato on my rooftop by self-initiative and collected vines from the neighbors”
Camp 3, Female Gardener

Annex 2

(place holder maps only – high quality pdf to be included in final version and [here](#))

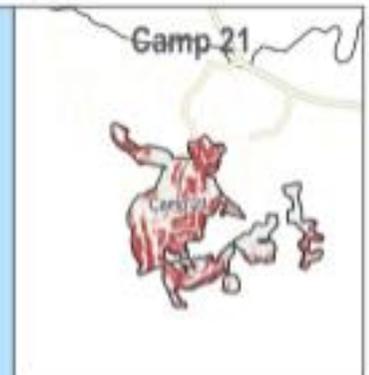
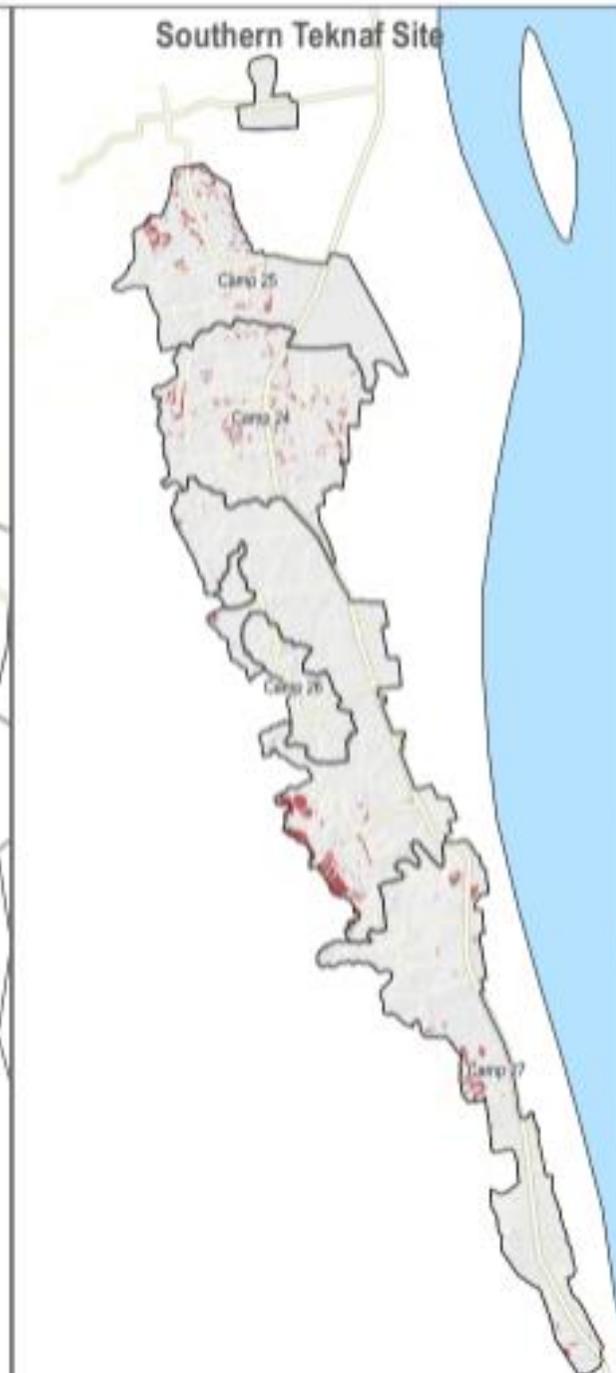
BANGLADESH - Rohingya Refugee Crisis - Cox's Bazar District Block Level Landslide Susceptibility

For Humanitarian Purposes Only
Production date: 31.05.2021



BANGLADESH - Rohingya Refugee Crisis - Cox's Bazar District
Landslide Hazard Susceptibility Model

For Humanitarian Purposes Only
 Production date: 31.05.2021



Landslide Susceptibility
 For Kutupalong
 Moderate
 High
 For Teknaf
 Potentially Affected Area
 Roads

Description:
 This map shows different landslide susceptibility zones. It is based on a model using machine-learning technology derived by NASA through the NASA/RI-Columbia University led COMPAS Project. It is still under development and results should be considered as experimental.

Larger landslide susceptibility maps are available for the Ukhiya and Teknaf Camps (REACH).

Disclaimer:
 Data, designations and boundaries contained on this map are not warranted to be error free and do not imply acceptance by REACH.

All landslide susceptibility estimates carry uncertainty and the presence or absence of susceptibility does not guarantee the presence or absence of landslides. This map should not be used as a stand-alone tool but should be used alongside other expert judgement.

Data Sources:
 Camp Boundary: ISCG, 2020
 Block Boundary: ISCG, 2020
 Upazila Boundary: Bangladesh Bureau of Statistics, 2015
 Roads: ©OpenStreetMap Contributors
 Landslide Susceptibility: NASA, 2019

Coordinate System: WGS 1984 UTM Zone 46N
 Contact: reach.mapping@impact-initiatives.org

