



Climate-Smart Agriculture (CSA)

TRAINING MANUAL

Users' Manual for Development
Practitioners and Extension Workers



INTERNATIONAL CENTER FOR
CLIMATE CHANGE, AGRICULTURE AND
FOOD SECURITY



iii) Agro-forestry

Agro-forestry is a farming practice or system where agriculture, forestry and livestock interventions are integrated to maximize the land productivity and get benefitted from multiple crop yield. It is a community-based adaptation practice to increase community resilience to climate change and also contributes to mitigation by reducing greenhouse gas (GHGs) emission in response to climate change. Furthermore, this practice plays a positive role in minimizing soil erosion particularly in sloppy areas as it provides dense canopy and there's proper use of soil nutrients due to plants with a different root system hence enhance organic matters in soil, minimize loss by floods and increase water availability (Nuryati et al., 2019). This farming system is appropriate for mid hills and high hill areas, but can also be applied in the Terai region especially for plantation crops. Agro-forestry contributes to CSA pillars in following ways:



Agro-forestry system

Adaptation	Mitigation	Food security
<ul style="list-style-type: none"> • Proper use and recycling of nutrients in the soil. • Increase organic matter in soil and reduce soil erosion. 	<ul style="list-style-type: none"> • Enhance carbon sequestration through sustainable land use management. 	<ul style="list-style-type: none"> • Integrated farming of diverse crop plants and livestock allow multiple crop harvest and increase overall productivity of the farming system.

Box 4. Examples of agroforestry practices in Nepal (ASHA, 2018)

- Agriculture crops and trees: *Albizia lebbbeck* Siris+ Tea; *Ulnus nepalensis*/Utis + large cardamom/tea; *Dalbergia sissoo*/Sisau + coffee; Pakhuri + black peeper, etc.
- Forestry and livestock: Livestock + fodder/ forage
- Agriculture, forestry and livestock (Bakaino and/or Epilipil + maize/millets + goat keeping; colocasia/ginger/turmeric + fodder tree + livestock)

iv) Leaf colour chart (LCC)

Leaf Colour Chart (LCC) is one of the CSA technologies which is used to determine the requirements of nitrogen fertilizer to cereal crops, especially for rice, wheat and maize, based on the greenness of the plant leaf. LCC is a decision support tool to estimate the appropriate amount of nitrogen fertilizers to use especially in cereal crops. LCC comprises six green strips, with colour ranging from yellow-green to dark green as per the amount of nitrogen content (amino acids) in leaves. This technology is suitable in all regions (Terai, hills and mountains) where cereal crops are cultivated. This is considered as a women-friendly tool as they can easily handle this with simple instructions.



Use of leaf colour chart in wheat

Picture: Anasuya Bhusal, LEAD/ID

The use of LCC contributes to CSA pillars in the following ways.

Adaptation	Mitigation	Food security
<ul style="list-style-type: none"> Reduce the incidence of disease and pests due to excess application of nitrogen fertilizer in crops and climate change. 	<ul style="list-style-type: none"> Reduce the emission of nitrous oxide gas due to optimum use of nitrogen fertilizer. 	<ul style="list-style-type: none"> Reduction of production cost. Increase crop productivity by proper use of fertilizer and minimizing the crop loss from lodging due to excess nitrogen fertilizer application.

D. Seed/breed-smart technologies and practices

i) Climate-resilient crops and crop varieties

Climate-resilient crops and crop varieties play an important role in climate change adaptation where crops can be cultivated under adverse climatic conditions. Drought is one of the key climate change problems. The fluctuation of rainfall patterns leads to long-term drought during the summer season and flood during the rainy season. Hence, drought and flood-tolerant crops and varieties are required to cope with this situation. Nowadays, there are drought and flood-tolerant rice varieties/cultivars available in Nepal (Box 5). Cultivation of those cultivars in

Box 5: Few climate-resilient crops and crop varieties available in Nepal

Rice: Drought tolerant cultivars; Sukha - 1, 2, 3, 4, 5 and 6; Flood tolerant; Bahuguni - 1 and 2

Maize: Heat tolerant cultivars; Rampur Hybrid - 8 and Rampur Hybrid - 10; Other maize cultivars; Ganesh - 1 and 2, Gulmi - 2, Manakamana - 1, 3, 4, 5 and 6, etc.

Wheat: Annapurna - 1, 2, 3 and 4; Dhaulagiri etc.

Other crops: Finger millets, buckwheat, proso millet

drought and flood-prone areas can help minimize crop loss during extreme climatic conditions. Some recently recommended improved climate-resilient maize and wheat cultivars in Nepal are shown in Box 5. Besides these major cereals, other local crops such as amaranth, proso millet, foxtail millet, finger millet, barley, buckwheat, etc., are climate-resilient crops. These crops can be cultivated in drought-prone areas and can obtain a good yield. The use of climate-resilient crops and varieties is one of the practical strategies to reduce climate change impacts and is suitable in all three agro-ecological zones of Nepal. Climate-resilient crop and crop varieties contribute to CSA pillars in the following ways.

Adaptation	Mitigation	Food security
<ul style="list-style-type: none"> Climate resilient crop varieties are better adapted under drought and flood conditions. Pest and disease resistant cultivars can overcome the incidence of pests and diseases due to climate change. 	<ul style="list-style-type: none"> Cultivation of crops during dry period can contribute, as an add-on, to carbon sequestering. Cultivation of disease tolerant crops reduces the use of pesticides. 	<ul style="list-style-type: none"> Cultivation of climate resilient crop varieties maintains yield even under stress condition and contributes to improve food and nutrition security.