Food and Agriculture Organization of the United Nations

UNDERSTANDING THE FARMER FIELD SCHOOL

AGRO-ECOSYSTEM ANALYSIS BOARD

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Author

Muhammad Khalid Jam

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We work for what they want
We teach them by showing
and they learn by doing
They need a system
They need to transform
We can do this all together
We can learn a lot together
The farmers and we facilitators
In the farmer field school
We all together

Poem by
Muhammad Khalid Jam

Preface

The ecosystem-literacy training employed in the Farmer Field School (FFS) is vital for enabling smallholder farmers to master the management skills required for sustainable crop production intensification and diversification. This approach is fundamentally different from the approach used by more traditional existing extension systems designed for "technology-transfer" purposes.

The agro-ecosystem analysis (AESA) is the cornerstone of the FFS approach and is based on the ecosystem concept, in which each element at the crop/farm/field has its own unique role. It involves the crops or commodity observations, data collection, analysis, interpretations, and recommendations. Farmers use AESA method to understand the situation of agro-ecosystem in the FFS approach.

However, the method is still cumbersome and complex for unlettered farmers who have to deal with numeric and textual data. This remained a challenge for the facilitators to communicate with the farming community, who cannot easily write and read the data and perform analysis on a paper sheet. The same complexity exists in the presentation of the same AESA sheet by the unlettered farmer in front of other fellow farmers of field school. The new Jam's 4 colors based AESA board is devised to mitigate the challenge of illiteracy and some other challenges in participatory group learning including the difference of FFS members' age, education level, gender equality, wealth position and social activism. This pre-designed AESA board provides equal opportunity to all participants including literate, illiterate or poor literacy services. This AESA board along with the analytical color language named Jam's 4 Colors from FAO Pakistan has been recognized among the top innovations of 2020 by the FAO-RNE International Forum on Agriculture and Food System, Saudi Arabia.

Who this document is for

This document is intended for the field school practitioners, master trainers, facilitators, government extensionists and farmer facilitators, NGO's workers, private sector field staff and the other agriculture service providers who are implementing the FFS for the smallholder farmers education or wish to learn about educating the unlettered farmers and the other rural folks on the agro-ecosystem literacy, or simply the FFS friends. This document provides the insights into the salient aspects to understand the agro-ecosystem analysis boards developed for the three different cropping systems; cotton-wheat, rice-wheat and sugarcane inter-cropping systems. The AESA boards structure, components definitions, data observation considerations and its implementation with the use of the Jam's 4 colors are among the key topics in it.

Acknowledgments

This book is about the understanding of the farmer field school agro-ecosystem analysis board and its components definitions and the use of the Jam's 4 colors. Special thanks are due to Dr. Qu Dongyu (FAO Director General), Mina Dowlatchahi (Director, PSS and former FAO Representative to Pakistan), Furrukh Toirov (deputy FAO representative), Aamer Irshad (Assistant FAO Representative & Head of Programs), Dr. Faizul Bari (NRM Advisor), Rebekah Bell (Senior Project Officer), Dr. Robina Wahaj (Land and Water Officer, NSL), Banaras Khan (former Resilience Officer), Adnan Mirza (Operations Officer) and Fahim Ahmed (Provincial Coordinator) for their guidance, support and appreciation.

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Acronyms and abbreviations

AESA	Agro-ecosystem analysis
CCS	Cotton Critical Stages
CWCS	Cotton-Wheat Cropping System
FAO	Food and Agriculture Organization of the United Nations
FFS	Farmer Field School
ILO	International Labor Organization
J4Cs	Jam's 4 Colors
OCS	Onion Critical Stages
PARC	Pakistan Agriculture Research Council
RCS	Rice Critical Stages
RWCS	Rice-Wheat Cropping System
SICS	Sugarcane Inter-cropping System
VALUE	Visual Analytical Learning for Unlettereds' Education
WCS	Wheat Critical Stages

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1. The Farmer field school approach

The Farmer Field School (FFS) approach is about educating the people, their development and empowerment. It helps the rural communities to learn and to develop the skills required for informed decision-making in the complex domains: based on the accurate problem analysis in the local contexts, effective decisions can build on the local knowledge, understanding of the local agro-ecology/ agro-ecosystem, and the existing capacities.

The agro-ecosystem-literacy training employed in the FFS is vital for enabling the smallholder farmers to master the management skills required for the sustainable crop production intensification and diversification. This is radically different from the approach used by the more traditional extension systems which are designed for the "technology-transfer" purposes. The FFS gestated in the rice paddy fields of the Philippines and Indonesia in the late 1980s, emerging in response to an urgent problem of pest outbreaks, related to the policy-driven overuse and the misuse of the chemical pesticides. The initial FFS programs focused on the agro-ecosystem based integrated pest management (IPM), but proved effective in managing the problems in the complex systems, thus empowering farmers to improve the decision making based on the local conditions. This dynamic nature of the approach expended its thematic coverage from the IPM to climate resilient agriculture, agri-business, zero-hunger, food security and livelihood agenda for smallholders' education and capacity building. At the same time, FFS encouraged community development and action, with a view to adopt the learning process to different technical perspectives, and

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promoted advocacy on important issues for the local communities.

Aims and objective

- Education and capacity building of farmers
- Unifying the learning process across the board
- Facilitate equal participation in the learning process
- Enhance analytical skills
- Facilitating farmers' science – learning by doing through farmer-led science
- Strengthening ecosystem observation and conservation skills
- Empowering the farmers in decision making
- Make farmers skilled
- Make farmers expert

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2. Understanding the agro-ecosystem analysis

The agro-ecosystem Analysis (AESA) is the cornerstone of the field school approach and is based on the the ecosystem concept, in which the each element at the crop/farm/field has its own, unique role. It involves the crops or commodity observations, data collection, data analysis, interpretations or discussions and the recommendations. Through regular observation of a crop or commodity system, the AESA exercise helps to establish the interaction between the crop or commodity and the ecosystem as well as the other living and non-living factors. Data are collected based on the key factors observed to help put a process in place for the decision making. The analysis is performed in the sub-groups of four to five members to enhance the participatory learning. Each sub-group presents their observations and recommendations in the plenary sessions for the collective decision making on the management actions. The participants in the field school learn how to observe the crop, to analyze the field situation and to make the proper decisions for their crop or commodity management. This process is called the agro-ecosystem analysis. The AESA exercise improve the decision-making skills by:

- enhancing observational skills
- developing record-keeping skills by drawing the simple forms
- enhancing analytical skills
- generating discussions and sharing of farmer-to-farmer experience
- developing presentation skills to promote the communal decisions

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2.1 Challenges in the old AESA model

The farmers have been using the AESA method to understand the situation of the crop-ecosystem since the inception of the FFS approach. Although the AESA methodology is dynamic in its nature, and remain very effective and vital tool of the FFS approach in making farmers the expert. However, the method still includes a reasonable level of complexity where the farmer has to deal with the numeric and the textual data. This remained a challenge for the facilitator to communicate with the unlettered farming community, who cannot easily write and read the observations and perform the analysis on a paper sheet and even presentation of the same analysed AESA sheet.

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3. The Jam's 4 colors based new AESA board

The Jam's 4 colors is a color based shortest analytical language which enables the farmers in translating the facts into colors and colors into the decisions. This color language introduced for the analytical process has replaced the previous complex and unintelligible analysis model especially for the illiterate farmers i.e. a textual and the numerical centered ecosystem analysis model which had been practiced for 30 years in the history of the farmer field school approach since 1989.

The Innovation J4Cs is associated with the agriculture-based FFS learning approach which is being implemented in almost 90 countries across the globe. The innovation has also been selected among the top success stories 2020 by the FAO-RNE International Forum on Agriculture and Food System, Saudi Arabia.

The new learning scheme with J4Cs has very broad scope to be addressed and utilized in the new context of learning situation. It has been successfully implemented in more than 300 FFS on the crops, vegetables and orchards, women open school on homestead gardening and the livestock field school in Pakistan during 2018-21. The universal meanings of the J4Cs make them suitable for the particpatory learning models like the farmer business school, children ecological

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clubs, community clubs, problem-solution process, value management, discovery learning, farmer-led research actions, and other participatory agriculture extension methods for the human health, hygiene and nutrition awareness, non-formal education models, formal and non-formal participatory performance monitoring actions especially at community or household level etc. The new AESA board with the J4Cs analytical language is named as the visual analytical learning for the unlettereds' education (VALUE-everyone) Model.

The VALUE-everyone model is devised to mitigate the challenge of illiteracy and some other challenges in the participatory group learning including the difference of age, education level, gender equality, wealth position, social activism in the field school. The pre-designed AESA board provides equal opportunity to all the participants including literate, illiterate or poorly educated farmers in the season-long FFS program for the eco-literacy services. The following values have been considered during naming this model (VALUE everyone) as;

Visual - relating to seeing, a picture, piece of film, or display used to illustrate or accompany something.

Analytical - relating to or using the analysis or logical reasoning.

Learning - the acquisition of the knowledge or skills through study, experience, or being taught.

Unlettered - relating to illiterate or poorly educated people

Education - the process of receiving or giving the systematic instructions, especially at a school or university or field formally or informally.

3.1 Advantages of the new AESA board

The new AESA board with J4Cs has several advantages as;

Equality among the literate and unlettered: The innovation is convenient for all regardless of the literacy levels, age group, gender and the level of qualifications, rich and poor, small and large growers, experienced and un-experienced farmers.

Time efficiency: The use of J4Cs based visual AESA board is highly effective in terms of time required for data recording and analysis. It improves learning capacity of all the participants to capture the agro-ecosystem details in less time.

Enhanced learning: It is more visual, analytical, less textual and numeric centered. It enhances farmers' analyzing and presenting skills due to the use of less text and numbers.

Group discussions: A very strong dimension of the FFS methodology is the group discussion among the participants. The new AESA Board enhances the group discussion and helps in generating debate and keeping that debate alive for a longer time in the FFS sessions.

Colours meaning: The new AESA board for all types of crops and learning models have built-in-design with major part of J4Cs for the participatory data recording, analysis and presentation.

Easy to decide group action: The J4Cs language based AESA board keeps discussion open and make it convenient for deciding group actions.

Applicable for all the crops, commodities and actions: The new AESA board design is applicable for all type of participatory field school learning programs for the crops, commodities, ecosystems and community actions.

Weekly cumulative economic analysis: The new AESA board has a weekly cumulative economic analysis section. It records cumulative cost and income data of farming actions, which strongly impact on decision making about the interventions.

The agro-ecosystem analysis boards

The agro-ecosystem analysis boards are developed for the Farmer Field School on

A- Cotton-wheat cropping system (CWCS)

B- Rice-wheat cropping system (RWCS)

C- Sugarcane inter-cropping system (SICS)

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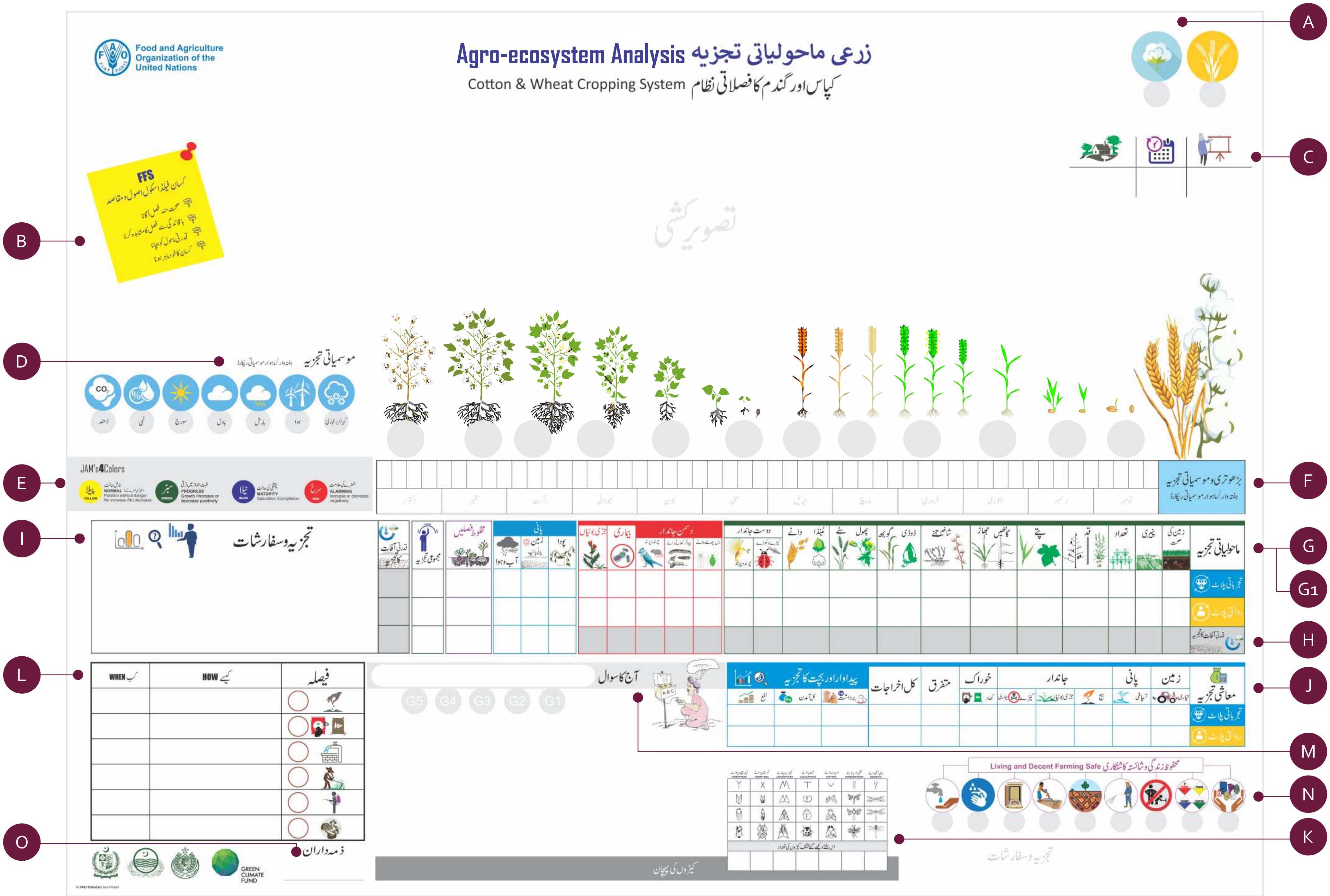

Food and Agriculture Organization of the United Nations
Agro-ecosystem Analysis زرعی ماحولیاتی تجزیہ
Cotton & Wheat Cropping System کپاس اور گندم کا فصلاتی نظام
A
B
C
D
E
F
G
G1
H
I
J
K
L
M
N
O
FFS
موسمیاتی تجزیہ
JAM's4Colors
NORMAL
PROGRESS
MATURITY
ALARMING
ماحولیاتی تجزیہ
تجزیہ وسفارشات
معاشی تجزیہ
آج کا سوال
G5
G4
G3
G2
G1
WHEN
HOW
فیصلہ
ذمہ داران
Living and Decent Farming Safe
GREEN CLIMATE FUND

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Food and Agriculture Organization of the United Nations

Agro-ecosystem Analysis زرعی ماحولیاتی تجزیہ

Rice & Wheat Cropping System چاول اور گندم کا فصلاتی نظام

A

C

B

FFS

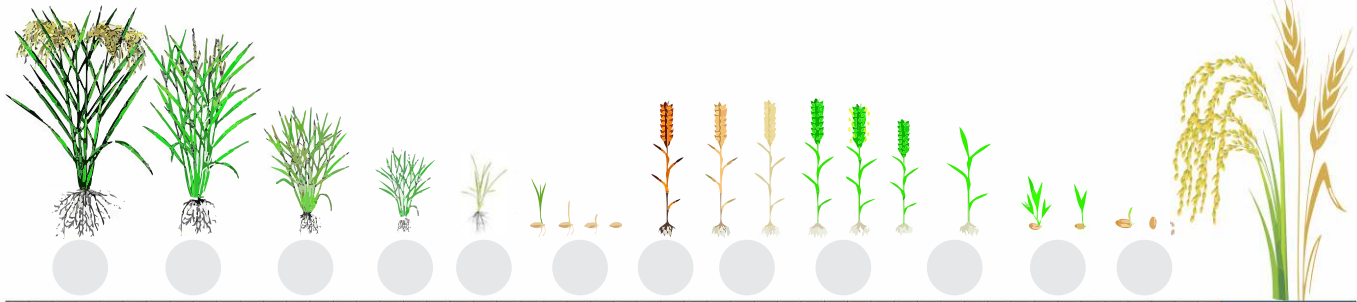
کسان فیلڈ اسکول اصول و مقاصد

- صحت مند فصل اگانا
- باقاعدگی سے فصل کا مشاہدہ کرنا
- قدرتی وسائل کو بچانا
- کسان کا خود مختار ہونا

تصویر کشی

D

موسمیاتی تجزیہ ہفتہ وار/ماہوار موسمیاتی ریکارڈ



E

JAM's4Colors

- YELLOW: Position without danger / No increase /No decrease
- GREEN: PROGRESS Growth /Increase or decrease positively
- BLUE: MATURITY Saturation /Completion
- RED: ALARMING Increase or decrease negatively

F

بڑھوتری و موسمیاتی تجزیہ ہفتہ وار/ماہوار موسمیاتی ریکارڈ

I

تجزیہ وسفارشات

G2

ماحولیاتی تجزیہ

- زمین کی صحت
- پنیری
- تعداد
- قد
- پتے
- مجھاڑ
- تنے
- گوبھ
- شے
- دانے
- دوست جاندار
- دشمن جاندار
- بیماری
- جڑی بوٹیاں
- پانی
- مقبوضہ فصلیں
- مجموعی تجزیہ
- قدرتی آفات کا تجزیہ
- تجرباتی پلاٹ
- روائتی پلاٹ

H

L

فیصلہ	HOW کیسے	WHEN کب

O

ذمہ داران

GREEN CLIMATE FUND

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آج کا سوال

G5 G4 G3 G2 G1

J

معاشی تجزیہ

- زمین
- پانی
- جاندار
- خوراک
- متفرق
- کل اخراجات
- پیداوار اور بچت کا تجزیہ
- تجرباتی پلاٹ
- روائتی پلاٹ

M

N

محفوظ زندگی و شائستہ کاشتکاری Living and Decent Farming Safe

K

کیڑوں کی پہچان

تجزیہ وسفارشات

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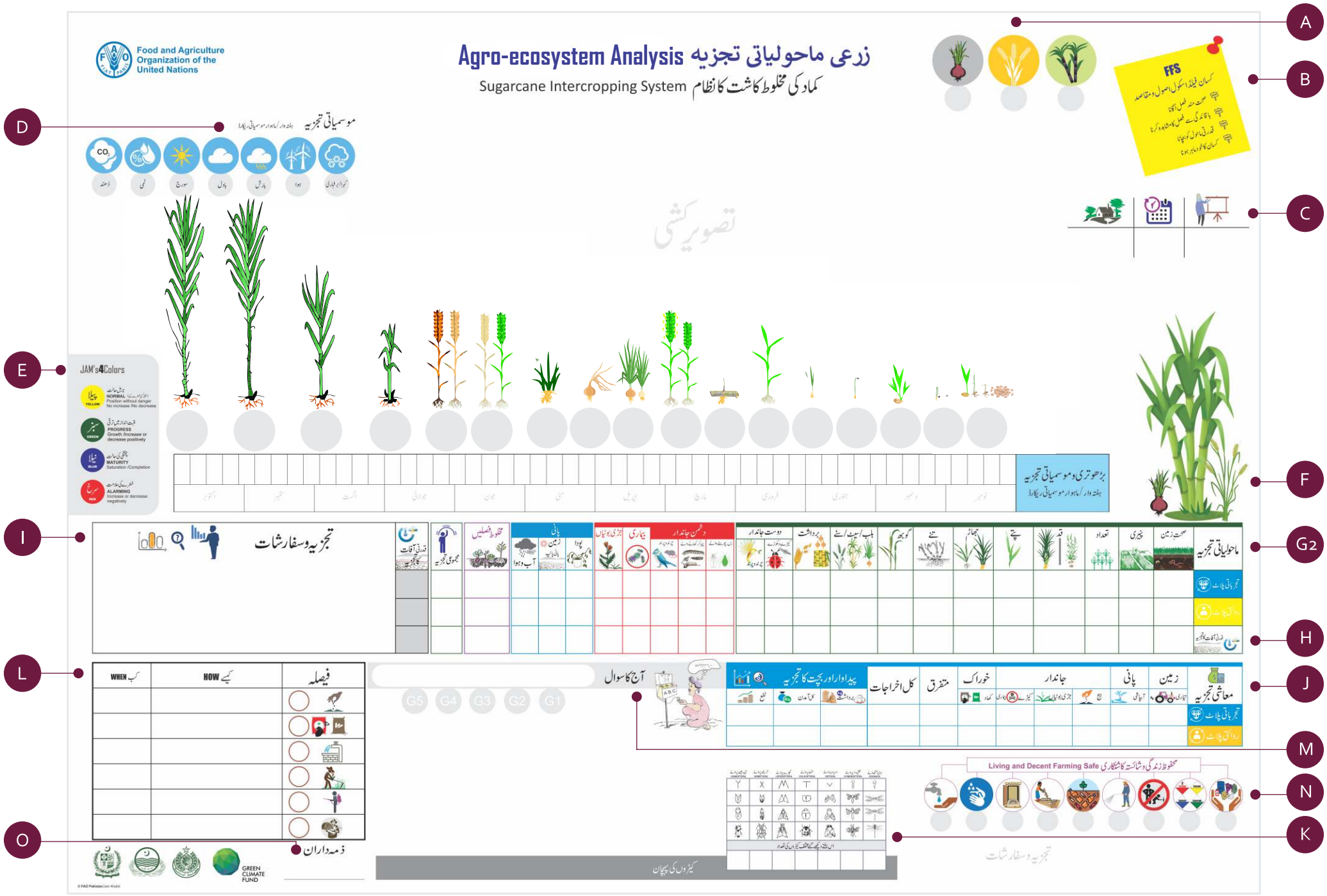
Food and Agriculture Organization of the United Nations
Agro-ecosystem Analysis زرعی ماحولیاتی تجزیہ
Sugarcane Intercropping System کماد کی مخلوط کاشت کا نظام
FFS
کسان فیلڈ اسکول اصول و مقاصد
صحت مند فصل اگانا
ماحول کے فصل کا مشاہدہ کرنا
قدرتی ماحول کو پہچانا
کسان کا خود مختار ہونا
موسمیاتی تجزیہ
JAM's4Colors
NORMAL Position without danger No increase /No decrease
PROGRESS Growth /Increase or decrease positively
MATURITY Saturation /Completion
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برجھوتری و موسمیاتی تجزیہ
ہفتہ وار/ماہوار موسمیاتی ریکارڈ
ماحولیاتی تجزیہ
تجزیہ وسفارشات
فیصلہ
کیسے HOW
کب WHEN
آج کا سوال
معاشی تجزیہ
زمین
پانی
جاندار
خوراک
متفرق
کل اخراجات
پیداوار اور بچت کا تجزیہ
ذمہ داران
Living and Decent Farming Safe محفوظ زندگی و شائستہ کاشتکاری
کیڑوں کی پہچان
GREEN CLIMATE FUND
A
B
C
D
E
F
G2
H
I
J
K
L
M
N
O

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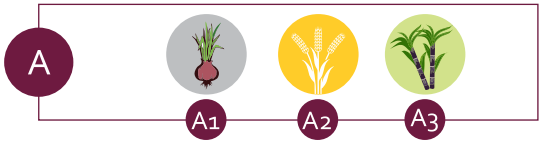
4. Agro-ecosystem analysis board components

The FAO Pakistan has developed and implemented the J4Cs based AESA boards VALUE-everyone models for the different cropping systems, (rice-whear, cotton-wheat and sugarcane inter-cropping), individual crops, (cotton, rice, wheat, sunflower), orchards, (general), homestead gardening and livestock field school system.

This manual is developed for the AESA boards on three different cropping systems including 1) cotton-wheat cropping system (CWCS), 2) rice-wheat cropping system (RWCS) and 3) sugarcane inter-cropping system (SICS). Each AESA board has fifteen major components with almost ±70 sub-components.

Followings are the components in the new AESA board model;

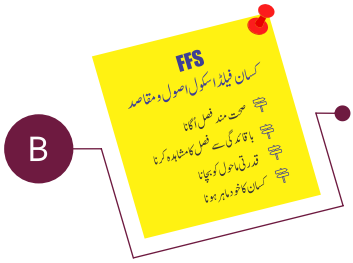


FFS LEARNING CROP(S)

A1 ONION CROP
Mark this icon if you have onion as the inter-crop with the sugarcane in the Field School as learning crop.

A2 WHEAT CROP
Mark this icon if you have wheat as the inter-crop with the sugarcane in the Field School as learning crop.

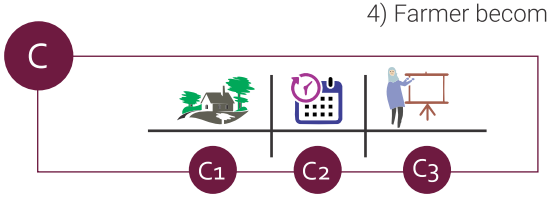
A3 SUGARCANE CROP
Mark this icon if you have sugarcane as the Field School learning crop.



FFS PRINCIPLES

Followings are the basic FFS principles which are considered as the FFS slogan and rhythm, recited in each session as well.

1) Grow healthy crop
2) Observe crop regularly
3) Save natural agro-ecosystem
4) Farmer becomes expert



GENERAL INFORMATION

C1 VILLAGE NAME
The name of the village where the field school is established.

C2 DATE AND TIME
Date and time of the field school session.

C3

SESSION NO.
The meeting or training event held from the establishment to graduation of the field school will be named as field school session and numbered accordingly.

D

D1 D2 D3 D4 D5 D6 D7

WEATHER COMPONENTS

D1

SMOG
It is a kind of air pollution, originally named for the mixture of the smoke and fog in the air. This icon represents both the fog or smog condition.

D2

HUMIDITY/AIR MOISTURE
The amount of the water vapor in the air is called humidity. It can be measured through the hygrometer.

D3

SUNSHINE
The Direct sunlight unbroken by the cloud, especially over a comparatively large area.

D4

CLOUDS
A visible mass of the condensed watery vapour floating in the atmosphere, typically high above the general level of the ground.

D5

RAIN
Rain is the liquid water in the form of droplets that have condensed from atmospheric water vapour and then become heavy enough to fall under the gravity.

D6

WIND
The wind is the moving air and is caused by the differences in air pressure within the atmosphere. The air under high pressure moves toward the areas of the low pressure. The greater the difference in the pressure, the faster the air flows.

D7

SNOW /FROST
The atmospheric water vapour frozen into the ice crystals and falling in light white flakes or lying on the ground as a white layer. The both frost and snow grow from water vapor in the air. However, snow forms high in the atmosphere around tiny suspended particles, while frost forms close to the ground on solid surfaces.

JAM's 4 COLORS (J4Cs)

The FAO Pakistan introduced Jam's 4 colors (yellow, green, blue and red) scheme in 2018 for the analytical learning to replace or minimize the use of textual and numeric centered data in doing the agro-ecosystem analysis. The J4Cs is a set of 4 colors with the predefined universal meanings used to analyze any situational data.

E1

YELLOW COLOR

The yellow color represents the position without danger, no increase, no decrease condition in any parameter observed.

E2

GREEN COLOR

The green color represents the situation of growth or improvement (positive increase or decrease) in any parameter observed.

E3

BLUE COLOR

The blue color represents the situation of the maturity, saturation or completion of any parameter observed. To take the informed decision in the decision box, the blue color represents the cessation of further input application and readiness of crop for the harvesting.

E4

RED COLOR

The red color represents the situation of danger or alarm (negative increase or decrease) for any parameter observed. It also emphasizes that the informed decision must be taken in the decision box. The consideration of the decision box is mandatory for this situation.

NOTE: The J4Cs can be developed from the printed stickers, markers, color pencils and/or color papers. However, The Pakistani team has found the most convenient method i.e. printed round stickers of 1 inches diameter (large stickers) and 1/4 inches diameter (small stickers) of all four colors.

F CROPS CRITICAL GROWTH STAGES AND WEATHER ANALYSIS

The critical period is commonly used to define the stage of growth when the plants are most sensitive to the shortage of water and essential nutrients. For example, most of the crops utilize and transpire more water in the later stages of the growth during which the moisture stress markedly reduces yield.

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F1 COTTON-WHEAT CROPPING SYSTEM CRITICAL GROWTH STAGES

In cotton-wheat cropping system, the cotton may have five while the wheat crop may have six critical growth stages.

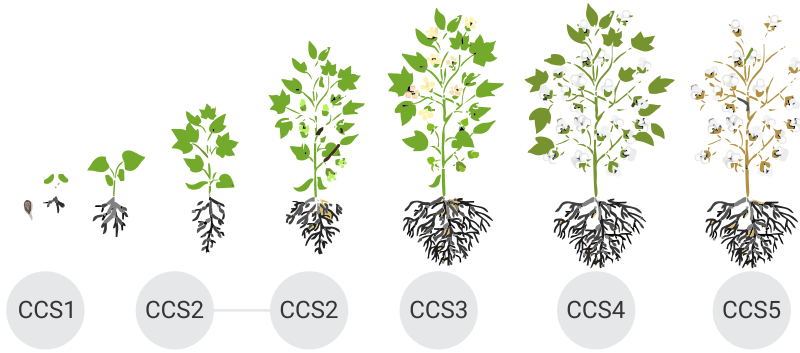


Image source: Cotton Development and Growth Staging © 2021 NUTRIEN

COTTON CROP

CCS1 Germination & emergence 4-9 days

CCS2 Leaf area & canopy development 10-40 days

CCS3 Flowering & boll formation 80-100 days

CCS4 Maturity ±150 days

CCS5 Harvesting (depends on indeterminate/determinate types)

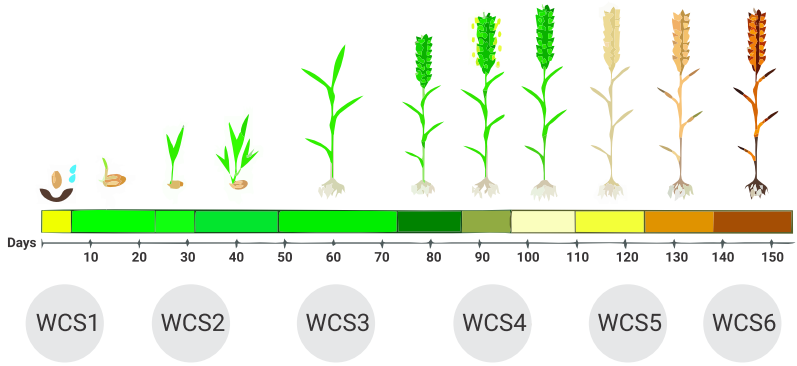


Image source: Sabella, E. *et al*. 2020. Impact of Climate Change on Durum Wheat Yield. *Agronomy*· MDPI.

WHEAT CROP

WCS1 Germination & emergence 5-10 days,

WCS2 Tillering 18-40 days,

WCS3 Stem elongation 60-70 days,

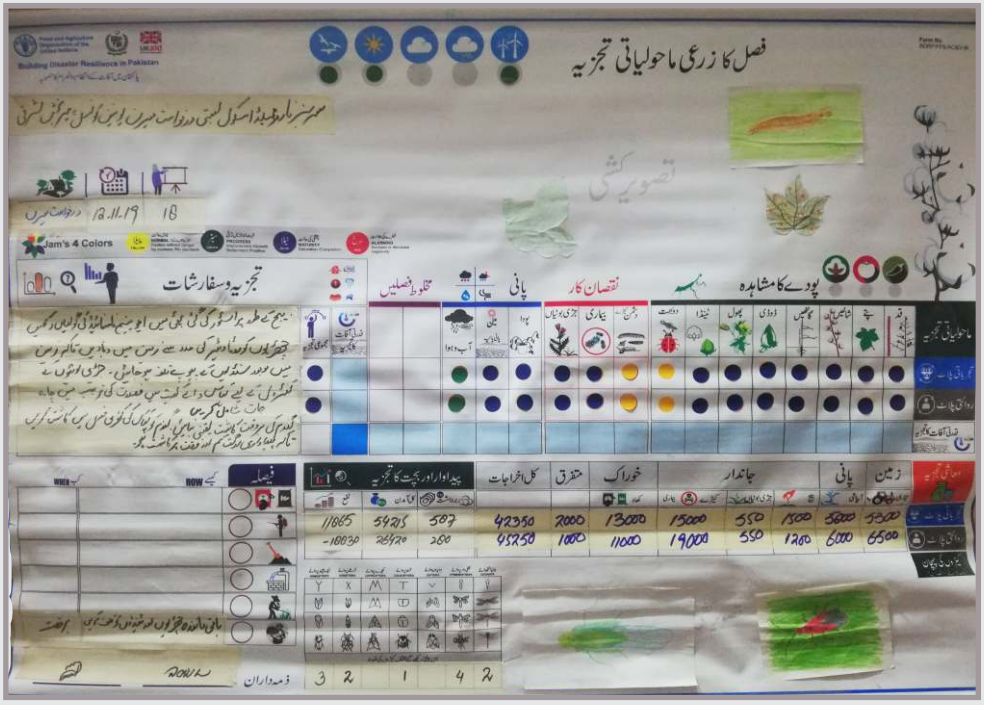
WCS4 Booting 90-105 days,

WCS5 Grain formation 105-140,
WCS6 Maturity 140-150 days.

WEATHER ANALYSIS

The recording of the overall state of weather parameters which contribute in crop growth during or over the respective month with the J4Cs and text (if required) with the white sticky tape (preferably white masking tape) in the analysis box. The FFS members relate the crop growth stage with the respective week and mark it with the relevant J4Cs stickers as per the collective analysis and decision.

For example, if the month remain favorable for healthy growth, then the month box can be marked with the green color sticker.



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F2

RICE-WHEAT CROPPING SYSTEM CRITCAL GROWTH STAGES

The rice-wheat cropping system may have six critical growth stages of the rice crop and six key growth stages of the wheat crop.

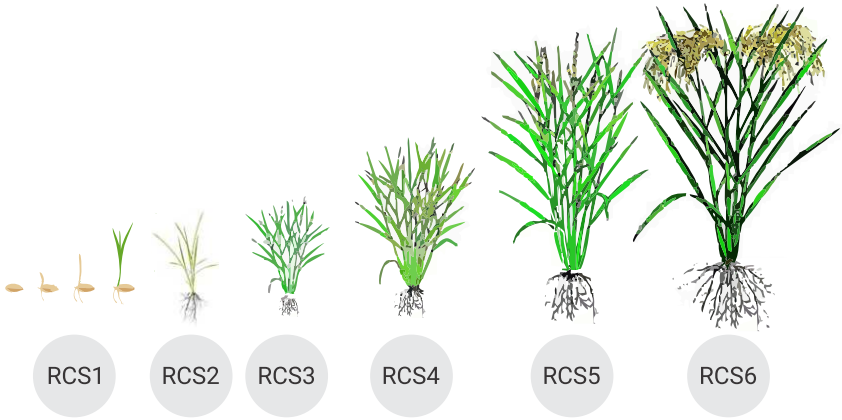


Image source: Nelson, A. *et al.* 2014.Towards an Operational SAR-Based Rice Monitoring System in Asia: Examples from 13 Demonstration Sites across Asia in the RIICE Project Andrew Nelson. *Remote Sensing*. MDPI.

RICE CROP

RCS1	Germination & emergence 3-5 days
RCS2	Tillering 12-25 days
RCS3	Stem elongation 30-75 days
RCS4	Booting 75-80 days
RCS5	Grain formation 90-105 days
RCS6	Maturity ±120 days

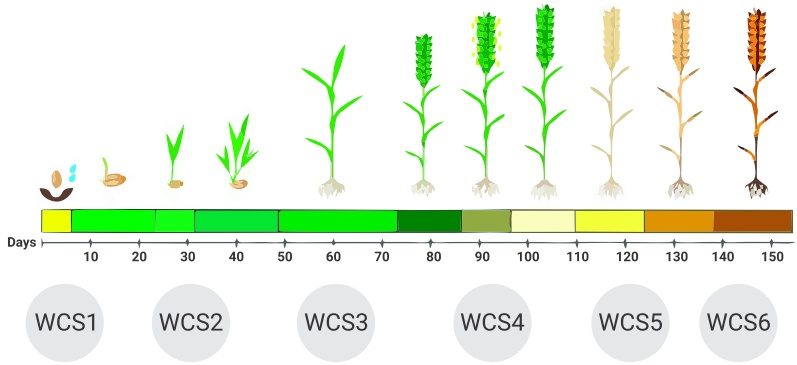


Image source: Sabella, E. *et al.* 2020. Impact of Climate Change on Durum Wheat Yield. *Agronomy*· MDPI.

WHEAT CROP

WCS1 Germination & emergence 5-10 days,

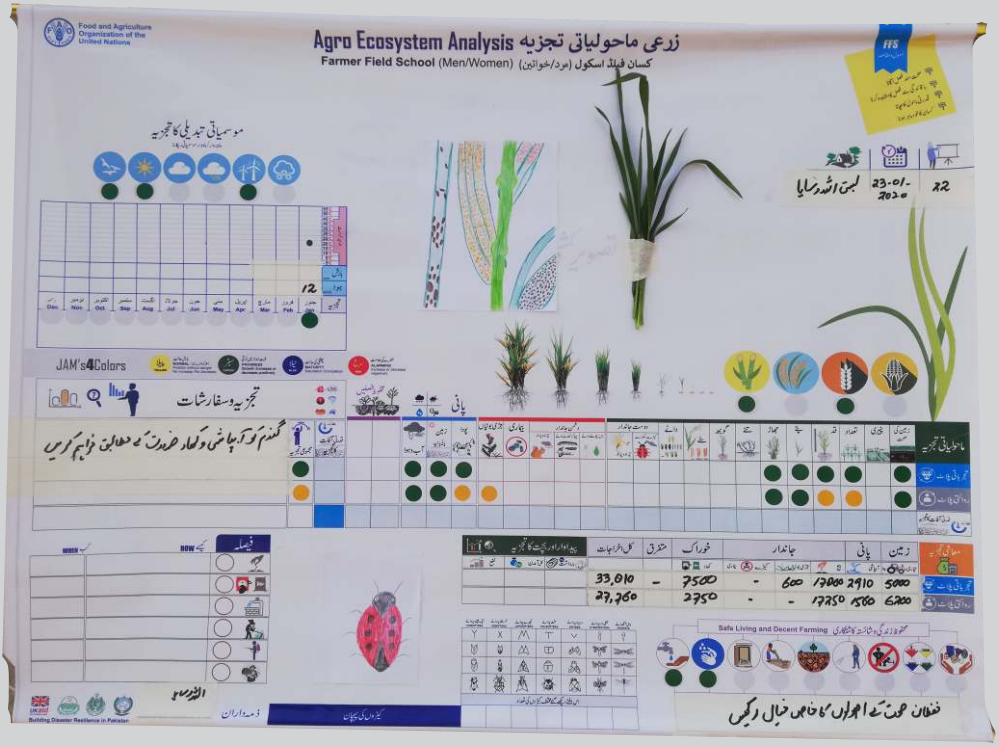
WCS2 Tillering 18-40 days,

WCS3 Stem elongation 60-70 days,

WCS4 Booting 90-105 days,

WCS5 Grain formation 105-140,

WCS6 Maturity 140-150 days.



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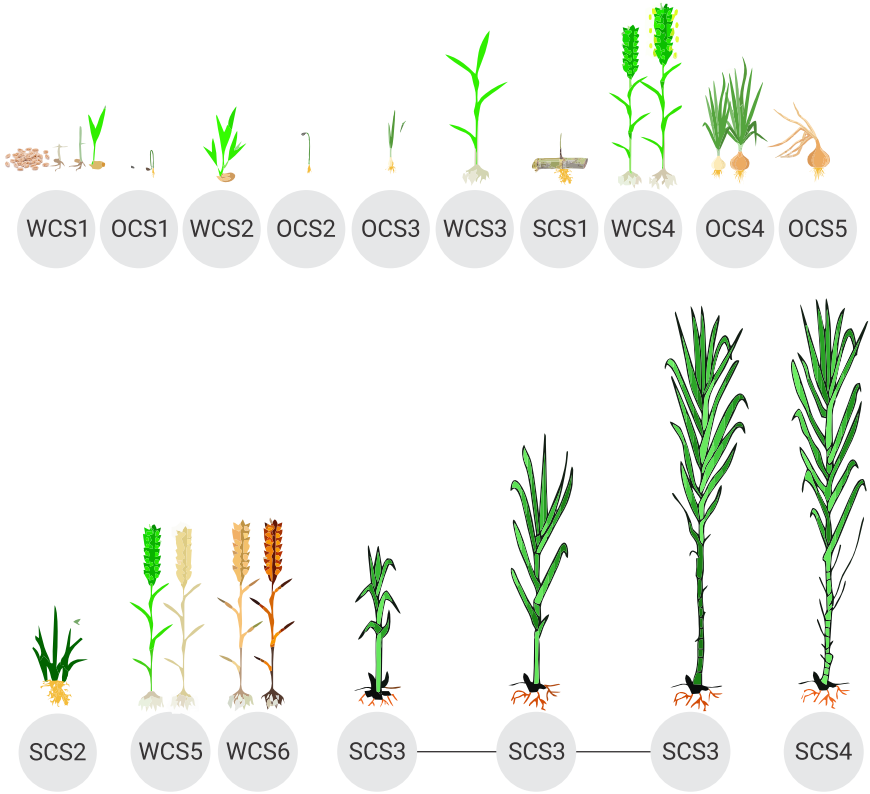
F3

SUGARCANE INTER-CROPPING SYSTEM KEY GROWTH STAGES

The sugarcane inter-cropping system may have 15 critical growth stages of the crops including four critical growth stages of the sugarcane crop, six critical growth stages of the wheat crop and five critical growth stages of the onion crop.



SUGARCANE CROP

SCS1 Sprouting 0-60,
SCS2 Tillering 60-150 days,
SCS3 Elongation 150-240 days,
SCS4 Ripening 240-360 days.

WHEAT CROP

WCS1 Germination & emergence 5-10 days,
WCS2 Tillering 18-40 days,
WCS3 Stem elongation 60-70 days,

WCS4 Booting 90-105 days,
WCS5 Grain formation 105-140,
WCS6 Maturity 140-150 days.

ONION CROP
OCS1 Establishment 25-30 days,
OCS2 Vegetative growth 30-60 days,
OCS3 Bulb initiation 60-90 days,
OCS4 Bulb development 90-135 days,
OCS5 Maturation 135-150 days.

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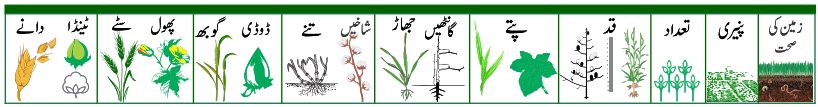
G CROPS GROWTH AND DEVELOPMENT PARAMETERS' ANALYSIS

FFS LEARNING PLOTS

The FFS comprises one learning plot and one control plot for the comparative learning by doing. 1) the learning plot represents the collective observations, decisions and actions by member farmers. 2) the control or conventional plot is a farmer plot where the farmer practices as per his/her routine conventional practice. The data recording for the AESA is mandatory for both learning and control plots of the field school.

COTTON-WHEAT CROPPING SYSTEM

G1



The analysis of the plant growth and development parameters may include the soil conditions, sowing of nursery (if applicable to the FFS learning crop(s)), plant population, critical growth stages and harvest. The following parameters represent the cotton-wheat cropping system.

G1a

SOIL HEALTH

The soil health is a state of the soil performing its range of ecosystem functions as appropriate to its environment. The soil health, also referred as soil quality, is defined as the continued capacity of the soil to function as a vital living ecosystem that sustains plants, animals and humans.

G1b

CROP NURSERY

A nursery is a place where the plants are propagated and grown to a desired age. In cotton crop, gap filling can be managed through raising a small nursery of the cotton plants in the cotton-wheat cropping system.

G1c

PLANT POPULATION

The plant population is defined as the total number of plants present at unit (acre) area of the land, while the plant spacing is the arrangement of the plants on an area. The yield of the crop is directly influenced by the plant population.

G1d

PLANT HEIGHT

The plant height is the shortest distance between the upper boundary of the main photosynthetic tissues (excluding inflorescences) on a plant and the ground level.

G1e

PLANT LEAVES

A leaf is a usually green, flat lateral structure that protrudes from a plant's stem to collect the sunlight for the photosynthesis and the site where transpiration takes place. The leaves are an absolutely essential part of any vascular plant for the processes of transpiration and photosynthesis.

G1f

(a) NODES

The main stem node is simply the point on the plant stalk where a joint with the side branch (either vegetative or fruiting branch) is formed.

(b) TILLERING

It refers to the production of the side shoots and is a property possessed by many species in the family Poaceae. This enables them to produce multiple stems (tillers) starting from the initial single seedling. This ensures the formation of dense tufts and multiple seed heads.

G1g

(a) BRANCHES

The basic structure of a cotton plant includes the main stem, which is made up of a series of the nodes and internodes, and two types of branches, the vegetative and fruiting branches.

(b) STALKS

The no. and health of the stalks for the sugarcane and wheat crop and bulb of the onion crop.

G1h

(a) FLORAL BUD OR SQUARES

A fruiting bud, called a square, begins to form at the initiation of the fruiting branch. The first square produced on a fruiting branch is referred as a first position square. The period of square development prior to bloom is called “squaring.” Once the cotton begins to bloom, it is said to be “flowering.” A cotton plant typically blooms or flowers for about 6 weeks.

(b) BOOTING

During the booting stage, the head of the wheat develops and becomes visible beneath the sheath on the stalk. The booting stage ends when the tips of the head, called awns, begin to emerge.

G1i

(a) FLOWER

A flower, sometimes known as a bloom or blossom, the seed-bearing part of a plant, consisting of reproductive organs (stamens and carpels) that are typically surrounded by a brightly colored corolla (petals) and a green calyx (sepals).

(b) SPIKE

The spike (also called the ear or head) forms at the top of the plant. For example, a wheat spike usually has 35-50 grains.

G1j

a) BOLLS

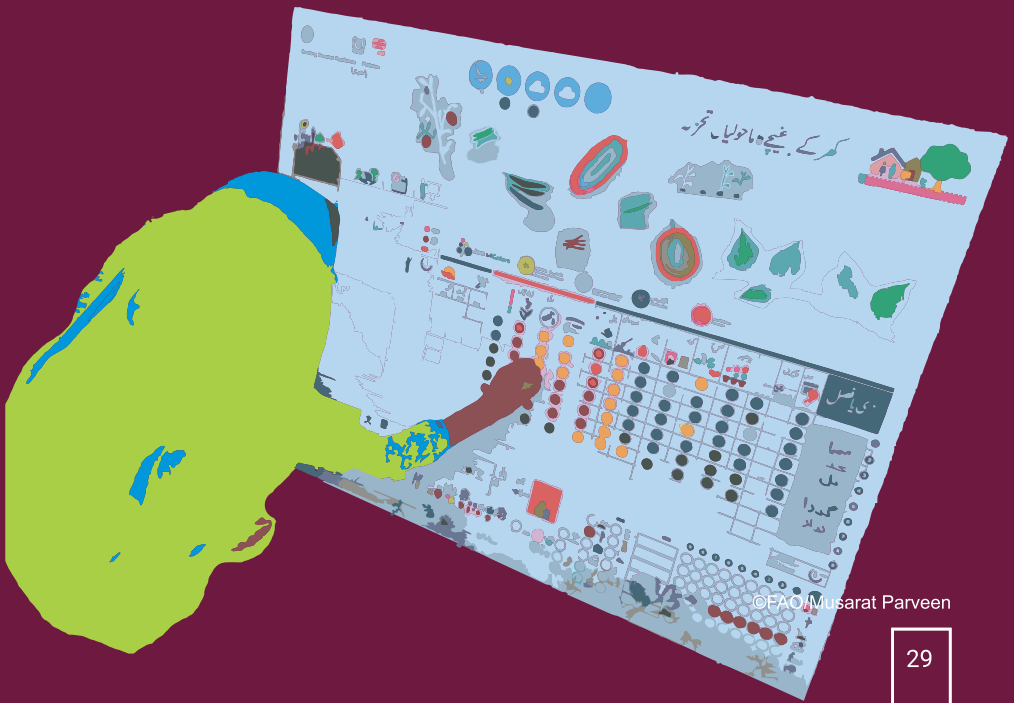
The round, fluffy clumps in which the cotton grows on a cotton plant.

b) KERNEL

The kernel is the seed from which the plant grows. It is also the part that humans and livestock eat. The kernel has 3 distinct parts: the bran, endosperm, and germ.

c) HARVEST

The harvest is the time when you reap what you sow. As a verb, to harvest something means that you pick or gather it. For example, there will be several harvest of the cotton depending upon the harvesting interval and the varietal characters.



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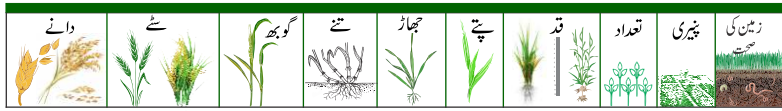
G2

RICE-WHEAT CROPPING SYSTEM



G2j G2i G2h G2g G2f G2e G2d G2c G2b G2a

The following parameters are for the rice-wheat cropping system (RWCS).

G2a

SOIL HEALTH

The soil health is a state of a soil performing its range of ecosystem functions as appropriate to its environment. The soil health, also referred to as soil quality, is defined as the continued capacity of the soil to function as a vital living ecosystem that sustains the plants, animals and humans.

G2b

CROP NURSERY

A nursery is a place where the plants are propagated and grown to a desired age. The rice nursery is developed in RWCS.

G2c

PLANT POPULATION

The plant population is defined as the total number of the plants present at the unit (acre) area of land, while plant spacing is the arrangement of plants on an area. The yield of crop is directly influenced by the population of plant.

G2e

PLANT HEIGHT

The plant height is the distance between the upper boundary of the main photosynthetic tissues (excluding inflorescences) on a plant and the ground level.

G2f

PLANT LEAVES

A leaf is a usually green, flat lateral structure that protrudes from a plant's stem to collect the sunlight for the photosynthesis and the site where transpiration takes place. The leaves are an absolutely essential part of any vascular plant for the processes of transpiration and photosynthesis.

G2g

TILLERING

It refers to the production of side shoots and is a property possessed by many species in the family Poaceae. This enables them to produce

multiple stems (tillers) starting from the initial single seedling. This ensures the formation of the dense tufts and multiple seed heads.

G2h

STALKS

The no. and health of the stalks for the sugarcane and wheat crop and bulb of onion crop.

G2i

BOOTING

During the booting stage, the head of the wheat develops and becomes visible beneath the sheath on the stalk. The booting stage ends when the tips of the head, called awns, begin to emerge.

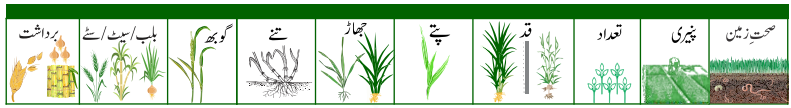
G2j

KERNEL

The kernel is the seed from which the wheat plant grows. It is also the part that humans and livestock eat. The kernel has 3 distinct parts: the bran, endosperm, and germ.

G3

SUGARCANE INTERCROPPING SYSTEM



G3j G3i G3h G3g G3f G3e G3d G3c G3b G3a

The following parameters are for the sugarcane inter-cropping system (SIS).

G3a

SOIL HEALTH

The soil health is a state of a soil performing its range of ecosystem functions as appropriate to its environment. The soil health, also referred to as soil quality, is defined as the continued capacity of the soil to function as a vital living ecosystem that sustains the plants, animals and humans.

G3b

CROP NURSERY

A nursery is a place where plants are propagated and grown to a desired age. Onion (for crop sowing) and sugarcane (for gap filling) nursery can be developed in the SIS.

G3c

PLANT POPULATION

The plant population is defined as the total number of plants present at the unit (acre) area of the land, while plant spacing is the arrangement of

plants on an area. The yield of the crop is directly influenced by the population of plants.

G3d

PLANT HEIGHT

The plant height is the shortest distance between the upper boundary of the main photosynthetic tissues (excluding inflorescences) on a plant and the ground level.

G3e

PLANT LEAVES

A leaf is a usually green, flat lateral structure that protrudes from a plant's stem to collect the sunlight for the photosynthesis and the site where transpiration takes place. The leaves are an absolutely essential part of any vascular plant for the processes of transpiration and photosynthesis.

G3f

TILLERING

It refers to the production of side shoots and is a property possessed by many species in the family Poaceae. This enables them to produce multiple stems (tillers) starting from the initial single seedling. This ensures the formation of the dense tufts and multiple seed heads.

G3g

STALKS

The no. and health of stalks for the sugarcane and wheat crop and bulb of onion crop.

G3h

BOOTING

During the booting stage, the head of the wheat develops and becomes visible beneath the sheath on the stalk. The booting stage ends when the tips of the head, called awns, begin to emerge.

G3i

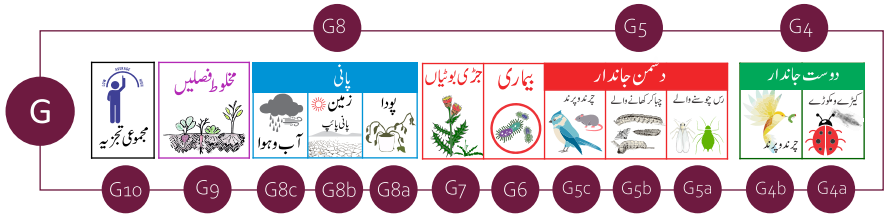
SETS AND BULB

The health, growth and size of sets (stalks for sugarcane, grain set for wheat) and bulb of the onion crop.

G3j

HARVEST

The harvest is the time when you reap what you sow. As a verb, to harvest something means that you pick or gather it. There will be three types of the harvest in the sugarcane inter-cropping system, starting from onion to wheat and then cane at later stage.



G4

CROP FRIENDS

The invertebrates (insects, pathogens) and vertebrates that kill the crop pests. They are also referred to as 'natural enemies' or 'biological control agents' of the pests. In many seasons they are important at suppressing the pest populations below the damaging levels.

G4a

INSECTS - Crop friends

The beneficial insects (sometimes friend insects) are any of a number of the species of the insects that perform the valued services like the pollination and pest control.

G4b

VERTEBRATES - Crop friends

The animal of a large group distinguished by the possession of a backbone or spinal column, including the mammals, birds, reptiles, amphibians, and fishes. The beneficial vertebrates perform the valued services in the crop production like pollination and pest control.

G5

CROP PESTS

Any animal, plant or pathogen harmful to the field crops. The harmful Insect normally known as the insect pest, are those insects that feed on, compete for food with, or transmit the diseases to the plants, humans, and livestock.

G5a

SUCKING INSECTS & PESTS

The insects having the sucking or piercing-sucking mouthparts includes the aphids, leafhoppers, thrips, whitefly, beetles and mites etc.

G5b

CHEWING INSECTS & PESTS

The insects with sharp and powerful mandibles are classified as “chewing insects.” They are able to cut and chew solid food such as the leaves, seeds or other insects. The grasshoppers, crickets, ants, cockroaches and earwigs are all the chewing insects.

G5c

VERTEBRATES PESTS

The animal having backbone or spinal column, including mammals, birds,

reptiles, amphibians, and fishes that perform the destructive services in the crop production like damaging the crop plants or crop friends.

G6

DISEASE(S)
An abnormal growth and/or the dysfunction of a plant. The disease is the result of some disturbance by the living and/or non-living causes in the normal life process of the plant. For example, the biotic diseases are caused by living organisms (e.g., fungi, bacteria, nematodes, viruses etc.).

G7

WEEDS
A weed is a wild plant that grows in the fields of the crops and prevents the plants that you want from growing properly. The weeds incidence and intensity recording can assist in analyzing the weed parameter.

G8

WATER SCOUTING
The water scouting is the process of precisely assessing the water/ moisture level and crop performance to evaluate the economic risk from the water stress, as well as to determine the potential effectiveness of the water stress control interventions.

G8a

PLANT WATER
The plant–water relations concern how the plants control the hydration of their cells, including the collection of water from the soil, its transport within the plant and its loss by the evaporation from the leaves. The flow of water through the plant and soil over the macroscopic distances is driven by the gradients in hydrostatic pressure.

G8b

SOIL MOISTURE
The soil moisture is the water stored in the soil and is affected by the precipitation, temperature, soil characteristics, and more. These same factors help determine the type of the biome present and the suitability of the land for growing crops.

G8c

ATMOSPHERIC MOISTURE
The water in the atmosphere makes up only a very small percentage of the total water on the earth. In the atmosphere, water exists as a gas (water vapour from evaporation), as a liquid (droplets of rain and liquid water that coats solid particles), and as a solid (snow and ice). However, its structure depends on its state.

G9

INTER-CROPPING
Growing plants/crop among plants/crop of a different kind. The inter-

cropping is a multiple cropping practices involving growing the two or more crops in proximity. The most common goal of the inter-cropping is to produce a greater yield on a given piece of the land by making use of the resources or ecological processes that would otherwise not be utilized by a single crop.

G10

AVERAGE OF ANALYSIS

It is the overall and average of impression of the all crop production parameters. It will guide the members to workout the final level of satisfaction with crop stand.

H

قدرتی آفات کا تجزیہ

NATURAL HAZARDS

The natural hazards are the naturally occurring physical phenomena caused either by the rapid or slow onset events which can be climatological (extreme temperatures, drought, and wildfires), biological (disease epidemics and insect/animal plagues), geophysical (earthquakes, landslides, tsunamis, and volcanic activity), hydrological (avalanches and floods), or meteorological (cyclones and storms/wave surges).

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I

تجزیہ وسفارشات

ANALYSIS

The detailed examination of the elements or structure of something carefully in a methodical way. If you analyze your crop-ecosystem analysis, you may determine its growth trend, crop pest and friend's population dynamic, disease and weeds incidence and severity, irrigation or fertilizer requirement, the need of any inter-cultural practice, weather interaction, and impact, etc.

SUGGESTIONS

An idea or plan that you offer for someone to consider. The suggestion may be a set of options offered to manage some problems. For example, to control whitefly, the field school farmer suggests the use of yellow sticky cards or use of chemical pesticides.

RECOMMENDATIONS

The recommendation means to advise someone that they should do something. A suggestion or proposal as to the best course of action, especially one put forward by the authoritative body. If you give someone a recommendation, you're saying, "try this, it's good" or "this is the best way to proceed," or "this action will make a positive impact."

J

J11 J10 J9 J8 J7 J6 J5 J4 J3 J2 J1

ECONOMIC ANALYSIS

Economic analysis is the study of economic systems or production processes or an enterprise. The FFS builds the capacity of farmers in doing an economic analysis of their enterprise (crop/commodity) by improving record-keeping of all production and marketing processes including its agricultural, ecological, financial, organizational, and management actions.

J1

LAND PREPARATION

The expenses including incurred on renting of land, ploughing, leveling, planking, bed preparation, etc.

J2

IRRIGATION

The expenses on irrigation including renting or fuel cost of tube-well, canal irrigation charges, high-efficiency irrigation system (HEIS) depreciation cost for a particular crop, and other operating costs incurred on managing irrigation for field school learning plots/farms, etc.

J3

SEED, SEEDLING, SAPLING

The expenses including seed value, seedling purchase, and seedling production cost, sapling or plants, seed treatment, etc.

J4

WEEDING AND HOEING

The expenses including weed control either by the machine or manual or chemical, labor charges, chemical cost, service or advisory charges, etc.

J5

PEST CONTROL

The expenses on the insect pests and disease control including the cost of material (chemical, non-chemical, organic), application or advisory service charges, etc.

J6

FERTILIZER AND NUTRIENT MANAGEMENT

It covers all the expenses or costs on chemical fertilizer, organic fertilizer, composting, farmyard manure, mulching, green manuring, fertilizer application charges, etc.

J7

OTHER MISCELLANEOUS EXPENSES

Any other costs or expenses incurred on the FFS learning plots including harvest charges, packaging cost, storage charges, transportation and marketing expense, market commission, government taxes, etc.

J8

THE SUM

The total amount resulting from the addition of two or more numbers, amounts, or items. All the expenses will be sum up finally to evaluate the profit and loss from the FFS learning plots or farms.

J9

PRODUCTION

The production is the organized activity of transforming resources into

finished products in the form of goods and services. The objective of production is to satisfy the demand for such transformed resources. During the FFS learning plots economic analysis, the overall production of the crop(s) or commodity including all its type of products will be counted. For example, In the wheat field school learning plot, there will be two types of produce, wheat grains, and wheat straw and these both will be measured in kilograms/mounds.

J10

REVENUE

The revenue is the income that a business or enterprise has from its normal activities, usually from the sale of produce, goods, and services. Income from all products will be calculated and summarized as revenue of the FFS learning plots.

J11

INCOME AND PROFIT

The net profit is the actual profit after working expenses not included in the calculation of gross profit has been paid. Its formula is, Revenue – Expenses = Net Profit

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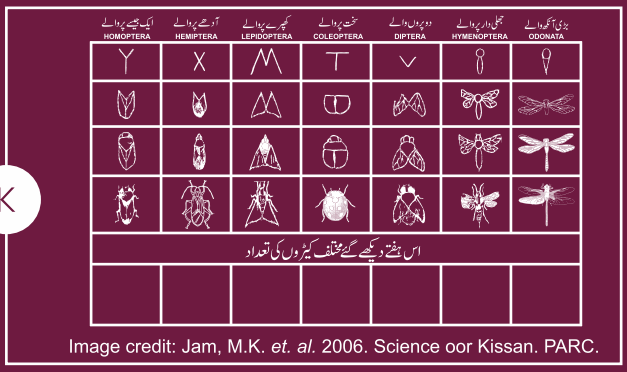

K

Image credit: Jam, M.K. *et. al.* 2006. Science oor Kissan. PARC.

INSECT ZOO AND DRAWINGS

Insect zoo and the drawing are the core activities of the FFS regular sessions to understand and identify insects. An insect is a small arthropod animal that has six legs and generally one or two pairs of wings. Insects or Insecta (from Latin insectum) are hexapod invertebrates and the largest group within the arthropod phylum. Insects have a chitinous exoskeleton; a three-part body (head, thorax, and abdomen); three pairs of jointed legs, compound eyes, and one pair of antennae. The provided insect drawing guide-chart is used for insects identification and drawing by farmers.

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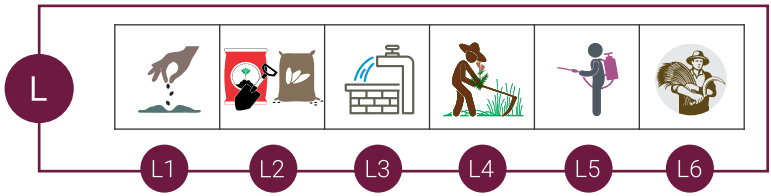


PARTICIPATORY DECISION

The action or process of deciding something or of resolving a question. In this section, the FFS members consolidate the suggestions and recommendations from all sub-groups and members to finalize field actions (decisions) about the learning plot/site of the crop/commodity. After a successful analysis of the agro-ecosystem for the FFS crop/commodity, the farmers conclude the AESA by making a final decision upon the suggestion and recommendations. The FFS facilitator is responsible to conclude the AESA with the participatory decision and its implementation action plan, including when to implement, how to implement, and who will implement. The key decisions made during the AESA may comprise the following six categories.

L1

SOWING /TRANSPLANTING

Any decision aiming at sowing of new crop seed in the field, transplanting of new/inter-crop seedling, or sowing/transplanting seedling for gap filling or thinning of plants in the grown crop will come under this category.

L2

FERTILIZER APPLICATION

A fertilizer is a chemical or natural substance added to soil or land to increase its fertility. This category covers chemical fertilizers as well as organic fertilizers available in packing. Any decision aiming at amending soil to provide nutrients to field crops and garden plants either in solid, liquid form of synthetic, chemical, and biochemical will come under this category.

L2

FARMYARD MANURE AND COMPOST

Farmyard manure is traditional manure and is most readily available to farmers. It is a decomposed mixture of cattle dung and urine with straw and litter used as bedding material and residues from the fodder fed to the cattle. Compost is an organic matter that has been decomposed in a process called composting. The decomposition process is aided by shredding the plant matter, adding water, and ensuring proper aeration by regularly turning the mixture when open piles or "windrows" are used. Any decision aiming at the application of organic material in the shape of compost, solid, liquid, or fresh manure, as well as mulching, will come under this category.

L3

IRRIGATION

The amount of water to the plants at needed intervals is known as irrigation. The irrigation helps to grow the agricultural crops, maintain landscapes, and revegetate disturbed soils in dry areas and during periods of less than average rainfall. Any decision aiming at supplying the water to crop by either tube-well, canal, high-efficiency irrigation system (HEIS) including drip, sprinkler, spate, artificial raining, etc. will come under this category.

L4

WEEDING AND HOEING

Weeding is an important control method practiced in many crops. The removal of weeds (unwanted plants) is useful because these unwanted plants compete with the crop for space, water, and nutrients. Weeding also helps to loosen the soil. Water can infiltrate more rapidly, and the roots of the cultivated plants can develop in a better way.

The hoe is any of several kinds of long-handled hand implement equipped with a light blade and used to till the soil, eradicate weeds. Hoeing is termed as to dig, scrape, weed, or till (surface soil) with or as if with a hoe. Any decision aiming at weeding or hoeing will come under this category.

L5

PEST AND DISEASE CONTROL

The pests are insects or small animals which damage crops or food supplies. The pest is a destructive insect or other animal or living being that attacks crops, food, livestock, etc. Any decision aiming at controlling the pest and diseases either by spraying chemical or non-chemical liquids is known as pest control. It includes any chemical, cultural, physical, biological, or social control method, pheromone traps, repellents, biopesticides.

L6

HARVEST AND MARKET

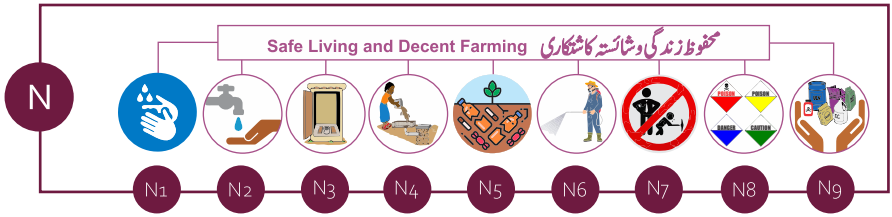
The harvest is the time when you reap what you sow. As a verb, to harvest something means that you pick or gather it. As a noun, harvest means the time of year when crops are ripe and ready to be gathered.

The market is a process that sets the price of the product with demand and supply forces. Conversely, marketing is a process that analyses, creates, informs, and delivers value to the customers. The concept of marketing is wider than the concept of a market. The market varies by product, place, and other factors. Any decision aiming at picking, harvesting, handling, storage, processing, value addition, packaging, transportation, and marketing will come under this category of decision making.

M

TODAY'S QUESTION / BALLOT BOX TEST

Today's Questions is a key component of participatory learning, especially in a brainstorming session. It gives opportunity to the facilitator for better planning and participants to brainstorm about innovative and interactive learning. Every week, the facilitator will organize and plan questions with samples, specimens for ballot box testing. All sub-group will respond to answer the question accordingly. The response will be recorded through J4Cs or just mentioning Yes or No. Commutative of all questions can be organized at the end of the field school as well as post test.



SAFE LIVING AND DECENT FARMING

The safe living and decent farming components are included in the AESA board to educate, train and support, and monitor the farmer's contribution. This component has been found very productive in making relevant special topics, recording farmers actions and contribution and change over the FFS training period.

This component is an integral part of all types of AESA boards developed for different cropping systems, crops, orchards, homestead gardening, and backyard livestock farming.

N1 HYGIENE

Hygiene is nurturing good hygiene practices, especially hand washing with soap. Although it sounds simple, this act is essential to prevent disease and for the health of children.

N2 WATER

The ability for children, women, and men to access safe water, the quality of the water they can access, and the journey they must take to collect it.

N3 SANITATION – TOILETS

The access and use of basic toilets and ways to separate human waste from contact with people. One important area of work for sanitation is to end the practice of "open defecation," and facilitate community-led initiatives to build, maintain and use basic toilets.

N4 SANITATION OF SEWAGE/GARBAGE

The disposal of waste water, disposal of garbage and cattle dung from home, street, or ways, the area of direct access to human and animal.

N5 SOIL CONTAMINATION

The soil contamination or soil pollution as part of land degradation is

caused by the presence of xenobiotics (human-made) chemicals, bottles or ingredients, or other alterations in the natural soil environment. It is typically caused by industrial activity, agricultural chemicals, or improper disposal of waste.

N6

PESTICIDE SAFETY

The pesticides safely depend on many things including selecting the appropriate product and using that product according to the label directions. The label directions are written to minimize the risk of problems and to define the legal uses for the product.

N7

CHILD LABOUR

Child labor refers to the employment of children in any work that deprives children of their childhood, interferes with their ability to attend regular school, and that is mentally, physically, socially, or morally dangerous and harmful. According to the ILO, child, labor refers to work that deprives children (any person under 18) of their childhood, their potential, and their dignity, and that is harmful to their physical and/or mental development.

N8

COLOR BANDS

The color band means a band printed at the bottom part of the label of color indicating the acute hazard of the pesticide product. Toxicity labels viz; red label, yellow label, blue label, and green label are mandatory labels employed on pesticide containers identifying the level of toxicity that is, the toxicity class of the contained pesticide.
Acute toxicity makes it possible to classify pesticides into five classes:

Class Ia –	Extremely Hazardous / Toxic
Class Ib –	Highly Hazardous/ Toxic
Class III –	Moderately Hazardous/toxic
Class IV –	Slightly Hazardous/toxic
Class V –	Virtually Hazardous/non-toxic

N9

PESTICIDES STORAGE, HANDLING AND DISPOSAL

Chemicals used to manage insects, rodents, weeds, molds and germs all have the potential to cause harm to workers. Pesticides come in different forms, including sprays, liquids, powders, granulates, baits and foggers.
The Container Matters - Pesticides should be stored in their original containers, which are designed to protect the product, and it is made of materials that will withstand the chemicals in the product. Store containers with their original labeling which includes application and disposal directions, ingredient names and emergency information. The original

container also has the appropriate lid/cap to protect kids and pets.

Temperature Matters - Extremes in temperature can change the chemistry of some pesticides inside the container and can damage containers. Always read the label for storage instructions. Generally, pesticides are best stored between 40-90 °F.

Location Matters - Designate a place that is only used for pesticide storage. Pick a well-ventilated location that children and pets cannot access, preferably with a latch or lock. Keep pesticides away from food, feed and flames. Choose a location away from ponds, streams and drinking water wells.

Safety Matters - Try to keep your pesticide inventory as low as possible. Buy only what you need this season; mix only what you need today. Dispose of unwanted pesticides properly rather than storing them. Never store pesticides in food or drink containers. Consider storing bottles inside a larger container that could contain liquids in the event of a leak or spill.

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RESPONSIBLE(S)

Name and signature of the responsible farmer for implementation of the participatory decision. This can be a host farmer or any other FFS member volunteering him/herself for the decided action implementation.

PRECAUTIONS

Use white sticky tape for writing purposes on the AESA board. Avoid direct writing by markers or pen on the board. For drawings, use flip charts/white paper. You can hang/paste live specimens on the board with masking tape or J4Cs stickers as well.

6. Data collection considerations

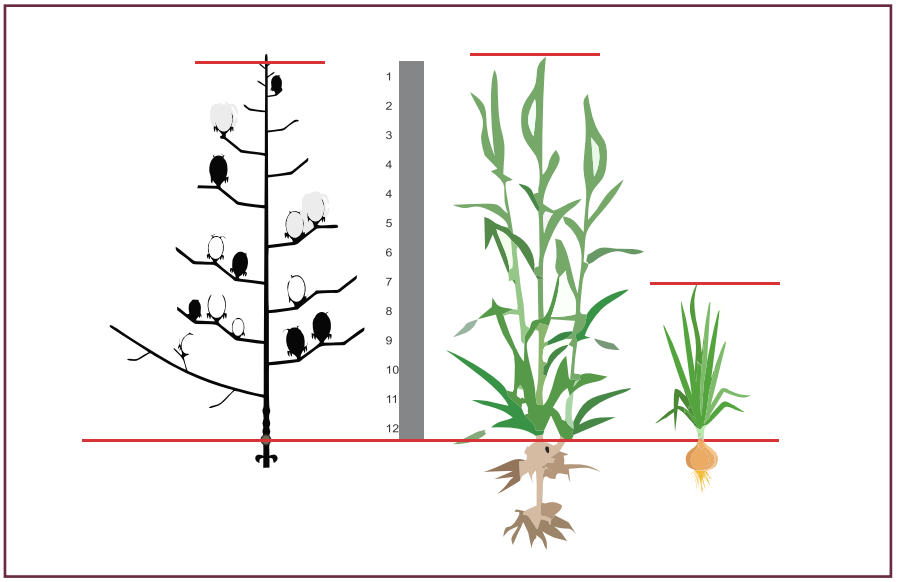
The following methodology will be appropriate in the data collection of different parameters during performing agro-ecosystem analysis.

6.1 PLANT HEIGHT

COTTON CROP
Measure plant height from first leaves node to the top leaves node.

WHEAT, RICE AND SUGARCANE CROP
Measure plant height of mother tiller from ground level to tip of the plant.

ONION CROP
Measure plant height from ground level to main leaf tip of the plant.



-Meter rod
-Measuring tape
-Foot scale
-Note pad
-Pen

6.2 PLANT LEAF

Consider following parameters for plant leaf as;

Color– Observe the active leaves of plants and record their color with the help of the colour chart.

Size– Leaf size

Shape– Observe the leaf shape and record the condition.

Leaf Position– placement of leaf at plant stem

Observe a top, middle and lower portion of the plant for leaf information.

- Leaf color chart (depends on crop variety/type)
- Note pad
- Pen

6.3 PLANT NODES

COTTON CROP

The basic point of reference for counting nodes on a cotton plant is the cotyledonary nodes. The cotyledons form the first nodes on the main stem of the plant and they are the only nodes which are directly opposite one another or parallel. When counting main stem nodes we use the cotyledon nodes as 0 node, then counting subsequent nodes up to the main stem toward the terminal of the plant.

6.4 PLANT BRANCHES /TILLERING

COTTON CROP

- Observe the number of vegetative branches.
- Observe the number of fruiting branches.

WHEAT, RICE AND SUGARCANE CROP

- Count the vegetative and productive tillers.

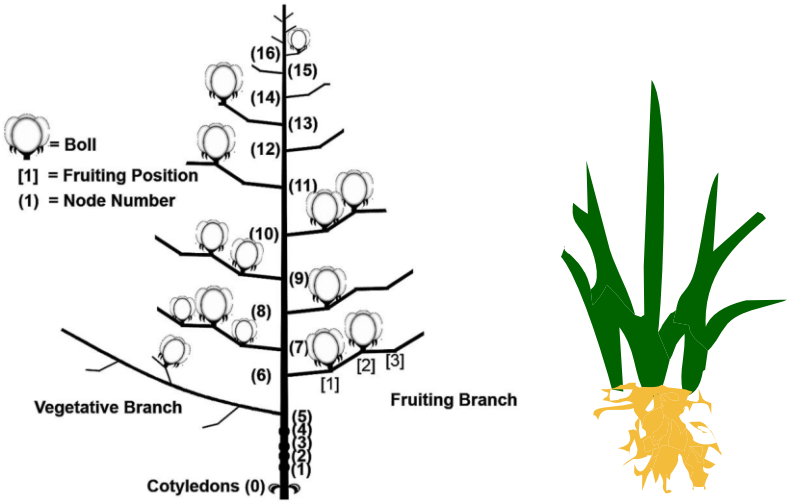


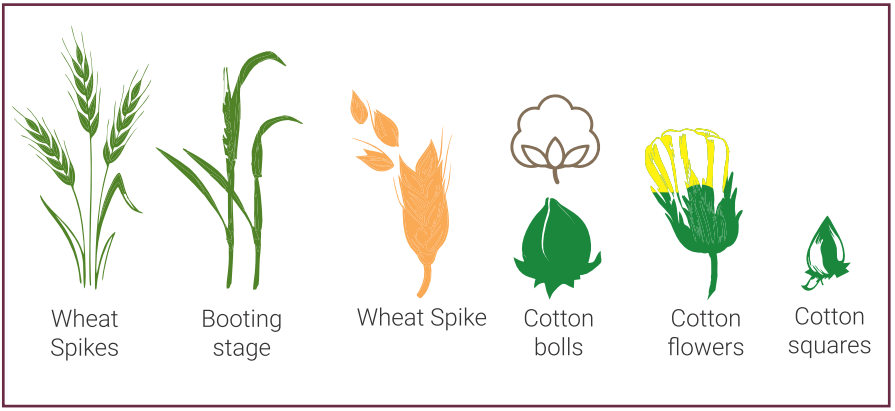
Image credit: UGA Extension © 2012-2021

-Note pad
-Pen

6.5 FRUITING BODIES

COTTON CROP
- Count number of healthy and damaged squares
- Count number of white flowers, fertilized, healthy or damaged flowers
- Count the immature or mature bolls or open bolls

WHEAT AND RICE CROP
- Count the tillers with and without spikes/heads.



-Note pad
-Pen

6.6 FRIEND AND FOE INSECTS

FRIENDS INSECTS
it includes predators, parasite, parasitoides etc. Observe on top, middle and lower leaves of the plant or complete plant and its canopy for friend insects. counting of

- Number of eggs
- Number of larvae
- Number of pupae
- Number of adults

PEST INSECTS
Sucking insects – Observe 20 leaves of 20 different randomly selected plants alternatively on upper, middle and lower leaves.

Chewing insects – Observe 25 complete plants and their canopies in a set of five plants each.

- Number of eggs
- Number of larvae
- Number of pupae
- Number of adults


Chewing Insects


Sucking Insects


Predators Insects


Parasitoide Insects

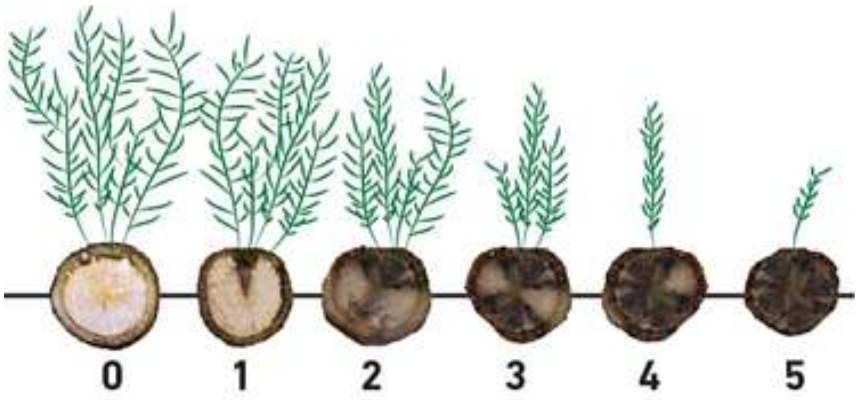
-Notebook with pencil
-Insect vials
-Magnifying glass
-Traps /net

6.7 PLANT DISEASE

Disease incidence – the proportion of the total number of plants that are infected. For example: Observe 100 plants randomly for % age incidence.

Disease severity – the proportion of total plant area that is infected. For example: observe 3-5 infected plants randomly with the following rating scale for disease severity.

Scale 0 – No disease
Scale 1 – 25% or less infection
Scale 2 – 26-50% infection
Scale 3 – 51-75% infection
Scale 4 – >75% infection with no constriction
Scale 5 – 100% infection with significant constriction of tissues



Disease rating scale

Source: https://keepingitclean.ca/canola/blackleg

-Notebook with pencil
-Disease rating scale

6.8 WEEDS SCOUTING

Weed incidence – the proportion of the total number of plants that are infected. For example: Observe 100 plants randomly for % age incidence.

Weed patches – the proportion of total plant area that is infected. For example: observe 3-5 infected plants randomly with the following rating scale for disease severity.

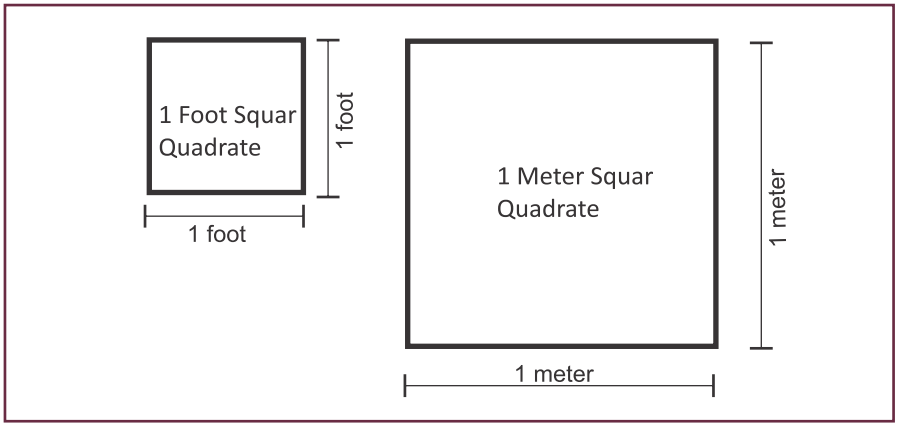
Weeds population – to measure the weed populations in a 1-acre field, make 5 random stops that are well spread out through the field. At each stop, use 1 meter /1 foot Square Quadrate for high-density crops (cereals etc.) or consider Plant canopy for bushy crops and record the following:

- Weed species present

- Life stage or height of weeds

- Life cycle (summer annual, winter annual, perennial)

- The severity of the infestation based on a number of weed plants (Low, medium, high) per crop plant canopy.



-Notebook with pencil
-1 Meter or 1 Foot Square Quadrate

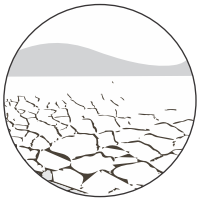
6.9 WATER SCOUTING

PLANT WATER
- Observe turgor pressure by breaking the top tender part of the plant.
- Observe flowers position in the plant top portion.
- Observe wilting of a plant in the morning time.
- Wilting of leaves at morning time
- Intermodal distance

SOIL WATER
- Use of soil moisture measurement tools like tensiometer and chameleon
- Make soil ball
- Observe upper soil conditions up to 5-6 inches

ATMOSPHERIC WATER
- Record weather forecast of at least one week
- Observe the present ecosystem conditions of the crop field

Atmoshperic Mositure



Soil Mositure

Plant Mositure

-Notebook with pencil
-Tensiometer
Chameleon
-Pani pipe (for rice crop)
-Weather updates (from met-department or Agriculture extension information department)

6.10 PLANT POPULATION

CROPS SOWN IN ROWS OR RIDGES (IN [LINE)

For example, the Cotton crop is sown on ridges at 2.5 feet row to row distance;

I. Divide row to row average distance with 43560 square feet (area of an acre). i.e 220X198=43560
ii. Divide the answer of A with row to row distance of the planted crop. For example, it is 2.5 feet in cotton, then the answer will be 43560/2.5=17424.
iii. Divide the answer of B with 1000. i.e. 17424/1000=17.424.
iv. Convert the answer of C (from feet) into inches by multiplying with 12/feet. i.e. 17.424 X 12 = 209 inches.
v. Convert the answer of D into sticks by dividing with appropriating no. (size) of sticks. i.e. 209/4 = 52.25 inches. It means you have 4 sticks of 52.25 inches each.
vi. Make a stick of size 52.25 inches and through in the field at 4 different randomized locations and count the no. of plants in each stick. For example, you have Stick 1= 6 plants, Stick 2= 5 plants, Stick 3=6 plants and Stick 4=4 plants. It means the total number of plants will be 21.
vii. Multiply the total no. of plants with 1000 to get the total population of the field (one acre). i.e. 21X 1000= 21000 plants per acre.

CROPS SOWN WITHOUT LINES /RIDGES OR ROWS

i. Make 2 square feet quadrate. i.e 2X2= 4 feet square.
ii. Count the plant population of the selected field (one-acre size) at a minimum of 4 different randomized locations and make an average of all. For example it is 33 plants (site 1=30, site 2=32, site 3=34 and site 4=36).

iii. Multiply average plant population i.e. 33 plants with the multiplication factor i.e. 43,560/4 = 10,890. Like 33 X 10,890 = 359,370 plants per acre.

-Notebook with pencil
-Measuring tape
-different sized sticks and knife
-4 square feet quadrate

©FAO/Musarat Parveen

7. Jam's 4 colors story

Translating facts into colors and colors into decisions!

©FAO/Muhammad Ramzan

EQUAL for literate & illiterate farmers

×2 promote work efficiency

more visual & analytical - less textual & numerical

promote group discussion

easy to decide the group action

applicable for all crops, commodities and actions

©FAO/Jam Khalid

8. Frequently asked questions

Question	Can we write with markers on the AESA board directly?
Answer	We can write with markers or pen on the AESA board by using separate paper or masking tape instead of direct writing on the board.
Question	How can we write data (numeric/text) on the AESA board in parameter boxes?
Answer	We can write numeric or textual data on colors stickers along with its analytical colors in the relevant boxes as well as on sticky tapes or paper.
Question	Can we mark the weeds population and harmful insects with green color if the numbers have decreased constantly by weeding?
Answer	Green color represents the progress of any parameter to its crop/commodity goal. If the decrease in weed population represents the progress toward crop production, it will be green and the same for harmful insect/diseases.
Question	If the population of beneficial insects increased constantly, can we mark it green and then blue?
Answer	Yes, the increase in beneficial insects population represents the progress and improvement in the field school learning crop plot. The blue color will be used when the desired beneficial insects population is achieved per plant. This can be measured by assessing the overall performance of beneficial and harmful population dynamics in the crop field.
Question	How a color blind person can use this color scheme?
Answer	This will be still a challenge for the new AESA board, however, we can manage it by using numeric and texts in the parameters boxes in addition to colors, so that the color blind can read, incase, he/she is not able to read, he/she has to rely on the sub-group.
Question	Can we use two different colors to prove a single situation?
Answer	We can use two different colors for one parameter in a dispute situation. This situation will definitely lead to an experiment for validation.

Question	Can the AESA board be filled by performing the AESA of only one (learning) plot?
Answer	AESA method is done for developing farmer's analytical skills in data collection, analysis and decision-making. It can be used for one learning plot to make decision only but comparative learning will be missing here. Once the farmers are graduated from the FFS, they can use AESA for their single plot for informed decision-making. However, for the FFS session, it is mandatory to do comparative AESA of two plots including one learning and the other control or conventional plot.
Question	Can we use only general observation for AESA chart instead of collecting detailed data as per defined data collection methods from the learning plots?
Answer	General observations can mislead in making the participatory decisions. Following minimum standards of data collection are mandatory for the AESA.
Question	Why the weather components be considered for the AESA?
Answer	Weather components are very critical to the crop ecosystem and have great considerations for decision-making.
Question	Who will be the decision-makers for the learning plots?
Answer	The FFS members will be responsible for the participatory decision of learning plot while host farmer for control plot. The facilitator role is simply facilitating the participatory decision-making process.
Question	Is it possible that half of the sub-groups of the FFS visit the learning plot and the rest of the sub-groups in the control or conventional plot for data observation?
Answer	It is possible when there is an alternate strategy of data observation for both learning and control plot for consecutive sessions just for the sake of comparative learning and group skills or time savings but it should not be taken as routine practice.
Question	What is the prime consideration while translating data into colors?

Answer	Crop stage and its performance with desired standards, farmers' experience, wisdom and level of satisfaction while technical information (production technology) could add value if shared in a participatory way by the facilitator or resource person.
Question	If there is no information about any parameter, what color will be used?
Answer	No color, when the relevant parameter's data do not exist, keep it blank.
Question	How much time the AESA exercise takes for crop analysis and decision-making normally?
Answer	It depends on data observation skills, crop stage and distribution of tasks among the team members. However, it can take 1-2 hours by using the new AESA board.
Question	How do farmers keep up the data of the previous AESA for comparison purposes with the new one?
Answer	The new AESA board model help you for keeping previous AESA record on it until unless you change it /revise it with current analysis. However, the details of all the previous AESA can be maintained on the FFS data books.
Question	Can farmers analyze the financial record on AESA board?
Answer	Yes, the new AESA Board has a comprehensive cumulative financial analysis which helps in decision-making as well.
Question	If farmers have to keep record of present week then how he will remember the previous one to calculate total expenditures?
Answer	No, present week financial transaction data will be added to the previous record. They have to cumulate it with previous data transactions to date. This will continue until the last harvest and income, profit and loss analysis.
Question	Do we have to draw the insects, weeds, plants or any other specimens drawings directly on the AESA board?
Answer	No, you need to draw them on separate paper and then can temporarily paste on it with masking tape of J4Cs stickers.
Question	Can we write recommendations directly on the AESA board?

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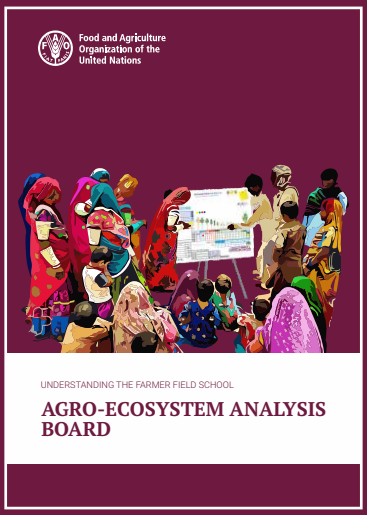

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