A REPORT FOR SOCIAL OUTREACH PROGRAMME ON DISSEMINATTION OF KNOWLEDGE OF STRESS TOLERANCE FOR AUGMENTING CROP PRODUCTIVITY AMONG THE FARMERS OF KALYANPUR, EAST BURDWAN, WEST BENGAL, 713104

Submitted By

SALEHA KHATUN

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Plant Physiology and Biochimistry Laboratory

UGC Centre for advanced study

Department of Botany ,The university of Burdwan

PLACE OF INTERACTION WITH THE LOCAL FARMERS

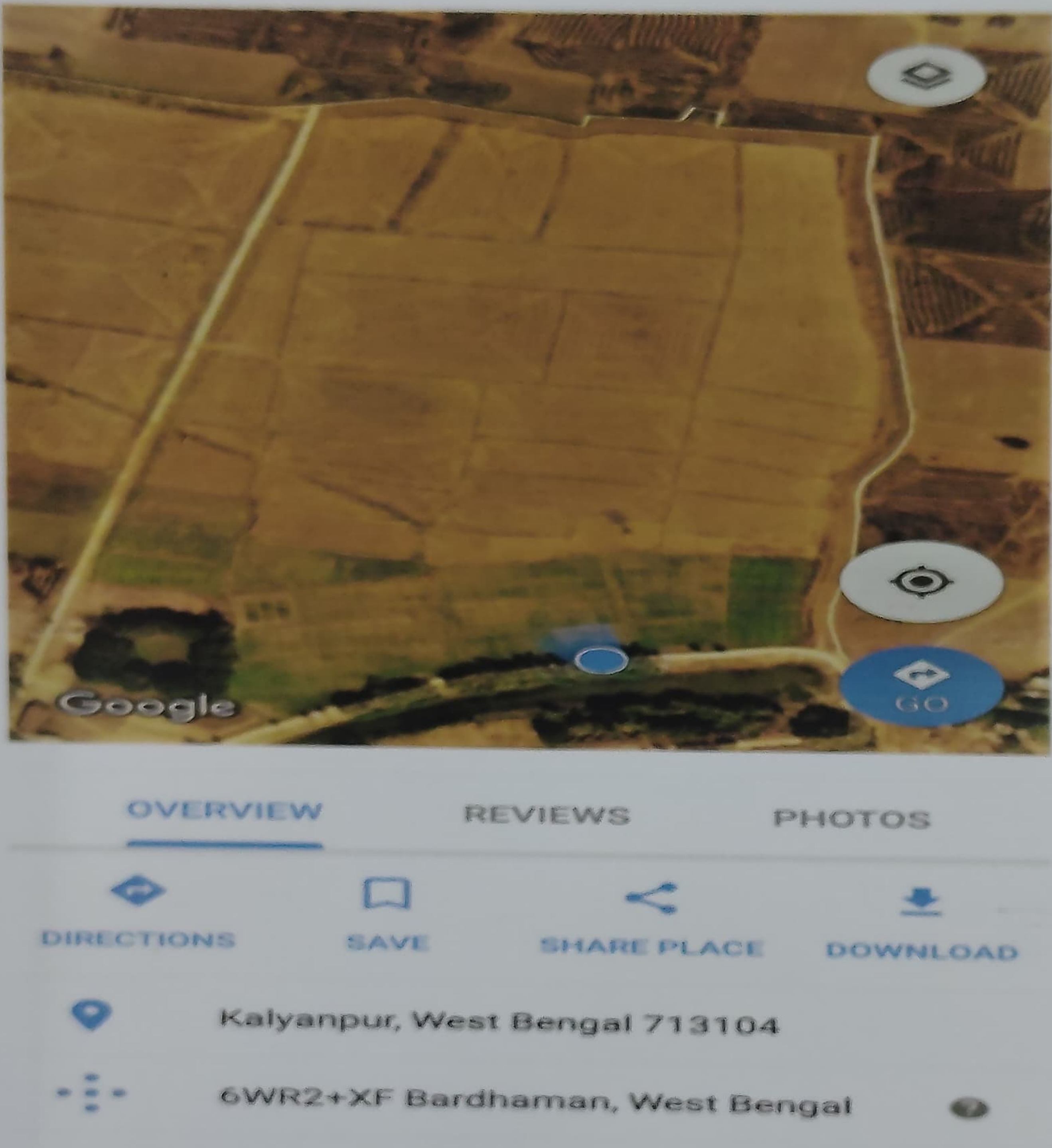

Figure 5 : EXACT LOCATION OF THE PLACE ON GOOGLE MAPS

স্থান :- কল্যাণপুর, পূর্ব বর্ধমান
পিন নং - ৭১৩১০৪

ক্রমিক নং	নাম	স্বাক্ষর
১	জালিম শেখ	জালিম শেখ
২	মুকুলাবি বেগম	
৩	শেখ আনোয়ার আলি	শেখ আনোয়ার আলি
৪	দীনু আঁকরা	দীনু আঁকরা
৫	আলাল হাজরা	
৬	বাসুদেব মণ্ডল	বাসুদেব মন্ডল
৭	ষষ্ঠী বাগদী	ষষ্ঠী বাগদী
৮	পদ্মা বাউরী	পদ্মা বাউরী
৯	আজি আলি	
১০	ঝুল্লু মান্ডি	ঝুল্লু মান্ডি
১১	গোলাপ শেখ	গোলাপ শেখ

Figure :- The list of the co-operative people.

INTRODUCTION

Plant stress is a state where the plant growing in non ideal growth conditions that increase the demand made upon it. The effects of can be lead to deficiencies in growth, crop yields, permanent damage or death if the stress exceeds the plant tolerance level.

Plant stress factors are mainly categorised into two main groups – abiotic factors and biotic factors. The abiotic factors include the different environmental factors that affect the plant growth (such as light, water and temperature), while the biotic factors are the other organisms that share the environment and interact with plants) such as pathogens and pestes). Response to stress usually involves complex molecular mechanism including changes in gene expression and regulatory network.

Stress tolerance can be useful way to identify functional abnormalities that may not be visible under normal condition. Stress tolerance mechanisms are activated when a stress factor reaches the cell surface or interior and damages the cell. The sequence of events following the damage and aiming to restore cell function is regarded as stress reaction. The stress reaction triggered by a signal from an appropriate receptor immediately after the beginning of the incidence of the stress factor.

Different kinds of stress and their impact on crop productivity

In today's climate change scenarios, crops are exposed more frequently to episodes of abiotic stresses such as drought, salinity, elevated temperature, submergence and nutrient deficiencies. These stresses limit crop production. In recent years, advances in physiology, molecular biology and genetics have greatly improved our understanding of crops response to these stresses and the basis of varietal differences in tolerance.

Stress – Definitions

(i) Physical terms

Stress is defined as the force per unit area acting upon a material, inducing strain and leading to dimensional change. More generally, it is used to describe the impact of adverse forces, and this is how it is usually applied to biological systems.

(ii) Biological terms

In the widest biological sense, stress can be any factor that may produce an adverse effect in individual organisms, populations or communities. Stress is also defined as the overpowering pressure that affects the normal functions of individual life or the conditions in which plants are prevented from fully expressing their genetic potential for growth, development and reproduction(Levitt, 1980,Ernst, 1993)

(iii) Agricultural terms

Stress is defined as a phenomenon that limits crop productivity or destroys biomass (Grime, 1979).

Classification Of Stresses

It has become traditional for ecologists, physiologists, and agronomists to divide stresses experienced by plants into two major categories: biotic and abiotic. Biotic stresses originate through interactions between organisms, while abiotic stresses are those that depend on the interaction between organisms and the physical environment. Strictly speaking, biotic stresses result from competition between organisms for resources, from predation and parasitism, and from the actions of allelopathic chemicals released by one organism and affecting another.

Abiotic Stress

Abiotic stress management is one of the most important challenges facing agriculture. Abiotic stress can persistently limit choice of crops and agricultural production over large areas and extreme events can lead to total crop failures. Abiotic stresses adversely affect the livelihoods of individual farmers and their families as well as national economies and food security.

Abiotic stresses include potentially adverse effects of Salinity, Drought, Flooding, Metal toxicity, Nutrient deficiency, High temperature and Low temperature. In addition, abiotic stresses can include Shade, UV exposurePhotoinhibition, Air pollution, Wind, Hail and Gaseous 363 deficiency which are often sporadic and highly localized in occurrence.

Plants can experience abiotic stress resulting from the shortage of an essential resource or from the presence of high concentrations of a toxic or antagonistic substance. In some cases, such as the supply of water, too little (drought) or too much (flooding) can both impose stress on plants. In reality, abiotic and biotic stresses are often inextricably linked.

Major Abiotic Stresses Limiting Crop Yield

Drought

Among the environmental stress factors, one of the most widely limiting for crop production on a global basis is water. According to one estimate, around 28 percent of the world's land is too dry to support vegetation (Kramer and Boyer, 1995). On a global basis, water is a paramount factor in determining the distribution of species, and the responses and adaptation of species to water stress are critical for their success in any environmental niche and for their use and productivity in agricultural ecosystems. Severe droughts occur periodically in several major food-producing countries, having far-reaching impacts on global food production and supply. The global production of grain has, in some years, been reduced by 5 percent or more as a result of severe droughts in key countries. It has been estimated that drought causes an average annual yield loss of 17 percent in the tropics (Edmeades et al., 1992), but losses can be much more severe and total crop failures are not unknown

Effects of drought stress on crops

- Reduced seed germination and seedling development
- Poor vegetative growth
- Reproductive growth is severely affected
- Plant height and leaf area reduced
- Significantly reduction in leaf weight
- Reduced photosynthesis.
- Reduced stomatal conductance

Mitigation of Drought Stress

1. Foliar spray of 2% DAP + 1% KCl during critical stages of flowering and grain formation

2. 3% Kaoline spray at critical stages of moisture stress

3. Foliar spray of 500 ppm Cycocel (1 ml of commercial product per litre of water)

Flooding stress

Definition: Flooding may be defined as any situation of excess water. Sudden inundation following high rainfall events also poses a severe physiological stress on crops. The gradual inundation of crop lands that occurs in a more regular cycle of seasonal changes in river levels and associated gradual flooding of crop lands poses a different, but equally challenging, flooding environment to which plants must adapt. As a result, some plants, such as rice, evolve a semiaquatic habit. Flooding stress in terrestrial species is referred to as waterlogging and the damage symptoms caused are primarily due to the prolonged exposure of the plants to hypoxia. The effect of waterlogging of roots and lower stems are apparent as a range of symptoms on the shoots, including rapid wilting and severe physiological disruption. Vast areas of rainfed crops, particularly in South and Southeast Asia, are annually affected by flooding

Effects of flooding stress on plants

1. Decay and death of leaves
2. Wilting
3. Abscission
4. Epinasty
5. Lenticels formation

Nutrient deficiency & Toxicity:

Under the anaerobic condition Fe toxicity is high. This leads to increase the polyphenol oxidase activity, leading to the production of oxidized polyphenols.

Iron toxicity symptoms:

¨ Tiny brown spots on lower leaves starting from tip and spread toward the leaf base or whole leaf colored orange yellow to brown

¨ Spots combine on leaf interveins and leaves turn orange brown and die.

¨ Leaves narrow but often remain green.

¨ In some varieties, leaf tips become orange yellow and dry up.

¨ Leaves appear purple brown if Fe toxicity is severe.

¨ Stunted growth, extremely limited tillering.

¨ Coarse, sparse, damaged root system with a dark brown to black coating on the root surface and many dead roots .

Mitigation of flooding stress

1. Providing adequate drainage for draining excessive stagnating water around the root system.

2. Spray of growth retardant of 500 ppm cycocel for arresting apical dominance and thereby promoting growth of laterals.

3. Foliar spray of 2% DAP + 1% KCl (MOP).

4. Spray of 0.5 ppm brassinolide for increasing photosynthetic activity.

5. Foliar spray of 100 ppm salicylic acid for increasing stem reserve utilization under high moisture stress.

6. Foliar spray of 0.3 % Boric acid + 0.5 % ZnSO4 + 0.5 % FeSO4 + 1.0 % urea during critical stages of the stress .

Salinity stress

One of the most common forms of land degradation results from soil salinization. Almost all of the continents have saline soils. However, salinity is predominantly a problem of arid and semiarid regions of the world, where the potential for evapotranspiration exceeds rainfall and there is insufficient rain to leach away soluble salts from the root zone (Miller and Donahue, 1990).

Effects of salt stress on plants

1. Osmotic effect or water deficit effect: Reduces the plant's ability to take up water, and this leads to slower growth. This is the osmotic or water-deficit effect of salinity.

2. Salt specific effect or Ion Excess Effect: Salts enter the transpiration stream and eventually injure cells in the transpiring leaves, further reducing growth.

· Plants grown in alkaline soils often display a characteristic yellow color on the new growth. Veins remain green, and the yellow color develops between veins. Severe deficiency may cause leaves to be almost white. Deficiencies of other micronutrients such as zinc and copper may produce a similar condition in peanuts. Chemical analysis of the plant tissue is the only sure way to differentiate.

· High salts can cause leaf burn, inhibit water uptake, and can interfere with uptake of certain essential elements (e.g., calcium).

· Stress at reproductive stages leads to spikelet sterility in cause of rice.

· Accumulation of Na+ and Cl- is toxic to cell in terms of the effect in enzyme activity.

Mitigation of salinity stress

· Seed hardening with NaCl (10 mM concentration)

·Application of gypsum @ 50% Gypsum Requirement (GR)

· Incorporation of daincha (6.25 t/ha) in soil before planting

· Foliar spray of 0.5 ppm brassinolode for increasing photosynthetic activity

· Foliar spray of 2% DAP + 1% KCl (MOP) during critical stages

· Sprayof 100 ppm salicylic acid

· Spray of 40 ppm of NAA for arresting pre-mature fall of flowers / buds / fruits

· Extra dose of nitrogen (25%) in excess of the recommended

· Split application of N and K fertilizers

· Foliar application of ascorbic acid alone increased number of leaves and leaf area, while in combination with zinc sulfate increased the plant height and total plant biomass.

· The exogenous application of PGRs, auxins ,gibberellins and cytokinins produces some benefit in alleviating the adverse effects of salt stress and also improves germination, growth, development and seed yields and yield quality

· Exogenous application of ABA reduces the release of ethylene and leaf abscission under salt stress in plants, probably by decreasing the accumulation of toxic Cl- ions in leaves.

· Post-application with exogenous Jasmonic Acid can ameliorate salt stress, especially the salt-sensitive rather than the salt-tolerant cultivar. 4 mM ascorbic acid and 4 mM gibberellin could increase transpiration rate, relative water content, chlorophyll *b*, total chlorophyll and xanthophylls content.

Temperature stress:

Definition

Greaves (1996) defines suboptimal temperature stress as any reduction in growth or induced metabolic, cellular or tissue injury that results in limitations to the genetically determined yield potential, caused as a direct result of exposure to temperatures above or below the thermal thresholds for optimal biochemical and physiological activity or morphological development.

High Temperature Stress

Levitt (1980) classified plants into psychrophiles, mesophiles, and thermophiles according to whether or not they tolerate low, medium, or high temperatures. Psychrophiles are those plants whose high temperature threshold is 15 to 20°C, mesophiles are those plants whose high temperature threshold is 35 to 45°C, and thermophiles are those plants whose high temperature threshold ranges from 45 to 100°C. Levitt (1980) proposed that the high temperature injury process progresses from a direct reversible strain, i.e., excess respiration over photosynthesis due to elevated temperatures, to an indirect strain, i.e., loss of reserves, or to a direct or indirect injury, i.e., starvation injury. High temperatures may be experienced by plants on a daily or seasonal basis. There is also growing evidence of long-term climatic changes leading to both higher average temperatures, widening the geographic range where high temperatures become routinely limiting to crop production, and increasing the frequency and severity of extreme temperature events. Plants may be as affected by exposure to prolonged periods of moderately high temperature as to short periods of extreme temperature, though the mechanisms for coping with these stresses may differ. Heat stress affects grain quality and yield.

Low Temperature Stress

Low temperatures can damage plants both by a chilling effect, leading to physiological and developmental abnormalities, and by freezing, causing cellular damage directly or via cellular dehydration. Lyons (1973) described many symptoms of low-temperature injury. Some physiological processes such as flowering in rice are extremely sensitive to low temperatures and damage may occur at temperatures as high as 20°C. Commonly visible symptoms of low-temperature injury to the leaves include wilting, bleaching due to photooxidation of pigments, waterlogging of the intercellular spaces, browning, and eventually leaf necrosis and plant death (Levitt, 1980; Witt and Barfield,1982). Dudal (1976) estimated that 15 percent of arable land is affected by freezing stress. Low temperatures can reduce crop yields in several ways. Chilling and freezing injury can directly affect crop growth by causing physical damage or by interfering with normal biochemical and physiological functions, thus reducing yield. More subtly, low temperatures reduce potential agricultural productivity by limiting the crops or varieties that can be grown in a particular area, with cold-tolerant species/cultivars often not those with the highest potential yield. Low-temperature exposure can be both a daily and seasonal factor to which plants must adapt, including, in some regions, prolonged periods of low temperature lasting many months.

Effects of Heat stress on Plants

¨ Seedling establishment is hampered

¨ Drying of leaf margins and scorching effect on leaves

¨ Reduction in plant growth

¨ Pollen development is affected

¨ Alteration in photosynthesis

¨ Total biomass is reduced

¨ Spikelet sterility

¨ Grain and fruit development and quality is affected

Mitigation of high temperature stress

- Plants need to be cultivated under shade condition.
- Overhead irrigation to avoid sunburn.
- Application of Gibberellic Acid Stimulate the α - Amylase production for seed germination.
- BAP reduce the leaf senescence & Lipid peroxidation .
- Salicylic acid enhances the Thermo tolerance capacity.
- Glycine betaine reduced the leakage of ion.
- Application of Ethylene enhance the seed germination

Mitigation of low temperature stress

- Foliar spray of 0.15 % Ammonium molybdate reduces the low temperature stress effect.
- Pre-soaking treatment with GA3 and Proline increase the Seed germination.
- Application of Paclobutrazol increases the activity of Scavenging enzymes.
- Electrolyte leakage is reduced by the application of Uniconzole (50 ppm).
- Cryoprotectants also used for reducing the stress effect.
- ABA has a role in induction of freezing tolerance.

Biotic stress

Stress that occurs as a result of damage done to plants by other living organisms, such as bacteria, viruses (although they are not considered to be living organisms, also cause biotic stress to plants), fungi, parasites, beneficial and harmful insects, weed and cultivated or native plants.

For example, browning of leaves on an oak tree caused by drought stress may appear similar to leaf browning caused by oak wilt, a serious vascular disease, or the browning caused by anthracnose a fairly minor leaf disease.

It is major a focus of agricultural research, due to the vast economic losses caused by biotic stress to crops.

Potential damage by biotic stress

- Fungi cause more diseases than any other biotic stress factor.
- Over 8,000 fungi species are known to cause plant disease .
- Not many plant pathogenic viruses exist, but they are serious enough to cause nearly as much crop damage worldwide as fungi.
- Microorganisms can cause plant wilt, leaf spots, root rot, or seed damage.
- Insects can cause severe physical damage to plants, including to the leaves, stem, bark and flowers. Insects can also act as a vector of viruses and bacteria from infected plants ti healthy plants.

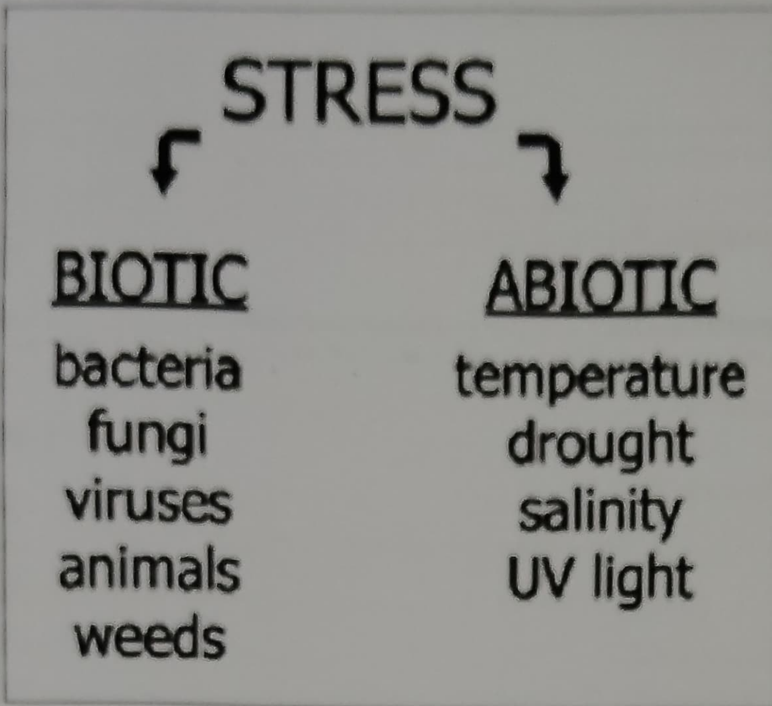

Figure- Components of biotic and abiotic stress

Crop Improvement

• A total of forty six high-yielding varieties (HYVs) have been released by the scientists of Rice Research Station, Chinsurah which as follows:

Panke, Bhupen, Jamini, Khanika, Kiron, Puspa ,Shatabdi, Khitish, CNRH-3, Kunti, CNM-25, CNM-31, Lakshmi (CNM-6) , CNRH 3 (Hybrid) Jogen, Bipasa, Sashi, Giri, Kaushalya , Kanak, Dhiren ,Sujala, Sabita, Purnendu, Amulya, Sudhir, Nalini, Biraj, Suresh, Mandira, Matangini, Golak, Saraswati, Bhagirathi, Bhudeb, Hanseshwari, Ambika, Mahananda , Sunil, Jaladhi-1, Jaladhi-2, Jalaprabha ,Neeraja, Jitendra, Dinesh Kalimpong – 1 and Munalame of the variety released.

Traditional rice varieties resistant to various abiotic and biotic stress in west Bengal:-

Biotic stress (disease resistant)	Sheath blight	Sindurmukhi
	Tungro	Kataribhog , Lathisal
	BLB	Badsabhog
Abiotic stress	Drought	Asanlaya, Vutmuri, Kelesh, Daharlagra, Dharansal etc.
	Salinity	Nona, Patnai-23, Dangrapatnai, Nonabokra.

A REPORT OF SOCIAL OUTREACH PROGRAMME ON DISSEMINATION OF KNOWEDGE OF STRESS TOLERANCE FOR AUGMENTING CROP PRODUCTIVITY :-

Locality of survey: - Village –Kalyanpur ; Dist : Burdwan East , Wst Bengal , Pin No.- 713104.

Date of survey :- 26. 07. 2019

Objectives of this programme

- To know the farmers awareness towards stress tolerance .
- To disclose the importance of stress tolerant variety for agriculture sector.

Social outreach programme report

Social outreach programme was done on 26/07/2019 at Vill- Kalyanpur , Dist- East Burdwan. Around 7-8 peoples were present at that time and they co-operate widely with us. We convince and aware them regarding the stress tolerance variety of crops for augmenting crop productivity .Here the farming is basically dependent on rice in this season . This the aman season (from july - august to November- january). The farmers of kalyanpur cultivates only few rice cultivars repeatedly during rice season such as ratna, swarna etc. I convince them to cultivate some disease resistant and stress tolerance rice cultivars like Panki, Bhupen, CNRH-3, CNM-25, Kelesh, Vutmuri etc. I distributed them some Xerox copy of handwrite about the stress & stress tolerance varieties of crops .

ফসলের উপর বিভিন্ন ধরনের চাপ (stress) ও ফসলের চাপ সহনশক্তি (stress tolerance) কিভাবে ফসলের উপর প্রভাব ফেলে তা সম্পর্কে আলোচনা।—

বিভিন্ন ধরনের উদ্ভিদ বিশেষ করে যেগুলো আমরা ফসল হিসাবে চাষ করে থাকি তারা বিভিন্ন সময়ে বিভিন্ন রকমের চাপের সম্মুখীন হয় ফলে উদ্ভিদের স্বাভাবিক বৃদ্ধি ও বিকাশের ক্ষতি হয় এবং ফসলের উৎপাদনও কমে যায়, যার ফলে চাষীদের আর্থিক ক্ষতি হয়।

বিভিন্ন রকমের উপাদান যেগুলি সাধারণত ফসলের চাপ (stress) সৃষ্টির জন্য দায়ী সেগুলি হল — খরা, বন্যা, উচ্চ তাপমাত্রা ও বিভিন্ন রকমের কীট-পতঙ্গ। এইসমস্ত উপাদান (factors) গুলি ফসলের যে সমস্ত ক্ষতিগুলি করে সেগুলি হল, ফসলের স্বাভাবিক বৃদ্ধি ব্যাহত হয়, ফসলের স্বাভাবিক উৎপাদন কমে যায় এমনকি উদ্ভিদের মৃত্যু পর্যন্ত হতে পারে।

কিন্তু উদ্ভিদবিজ্ঞানের অগ্রগতির ফলে বিজ্ঞানীরা বিভিন্ন প্রযুক্তিকে কাজে লাগিয়ে বিভিন্ন চাপ সহ্যকারী (stress tolerance) ফসলের বীজ আবিষ্কার করতে সক্ষম হয়েছেন। যে বীজগুলি চাষ করলে উদ্ভিদেরা উপরিউক্ত ক্ষতিগুলি থেকে রেহাই পাবে এবং চাষীরাও লাভবান হবে।

ধানের কয়েকটি উচ্চফলনশীল ও চাপ সহ্যকারী বীজের নাম নীচে দেওয়া হল —

সাহাক, দুধেশ্বর, CNRH-3, CNM-25
লাটিশাল, কেরালা, চারনক লাসরয়, দুধমুড়ি ইত্যাদি,