RESEARCH ARTICLE

SCREENING OF BEST ARSENIC TOLERANT RICE VARITY FOR ECOLOGICAL SECURITY AND SOCIO ECONOMIC DEVELOPMENTOFRICE GROWERSIN ARSENIC AFFECTED AREA

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Manuscript Info	*Abstract*
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The effect of arsenic causes inhibition of seed germination decrease in plant height reduction in root growth, leaf area and photosynthesis and low grain yield.Arsenic and its compounds are known to have adverse health effects on humans, including cancers of the skin, bladder, kidney & lung, and diseases of the blood vessels of the legs and feet and diabetes. Atoms of arsenic bond with other elements forms molecules — if carbon is one of these elements, then the arsenic compound is an organic compound. The toxicity of arsenic is more in inorganic arsenicwhich is a known human carcinogen — organic and inorganic together are referred to as "total arsenic. Inorganic Arsenate, Arsenate in ground water have caused tremendous epidemic poisoning across the globe. The persistence of heavy metals in the environment may pollute or contaminate soils and aqueous streams. Rice is cultivated an aerobically, rather than aerobically which leads to much greater arsenic mobilization.High soil arsenic caused by the reduction of phosphate and arsenate uptake through phosphate transporter. The goal of my work is to find method of reduction of arsenic content in rice. Rice is an important staple food for more than 3.5 billion people whodepend upon rice for more than 20 of their daily calories. It is cultivated over an area of 146 million hectares, which produces 474 million tons annually. Rice farming is the largest single use of land for food. India ranks number one globally in area 44 m ha under rice cultivation with 106 mt. production that stands next to China in total production. Our farmers are less aware in the field of use of rice variety specially arsenic tolerant. Although scientist have developed many good varieties of Rice but the information is either not reached to them or seeds are not available to the farmers so that the old variety they use may be not very nutritional, disease resistant and Arsenic tolerant.Instead of making people healthy they may be more effected by arsenic which causes dangerous diseases. Rice growers still face the challenge of meeting food and ecological security and raising standard of living of their families. To sustain even the present level of per capita availability of rice, we have to add another 70-80 million tones by 2050. This can be achieved by adopting long term strategy of crop productivity improvement,Arsenic and diseases resistant variety along with best growth management practice. I have taken this project on Quality and Quantity of Rice production for

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ecological security and socio economic development of Rice growers and rural people by use of correct suitable variety.

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Introduction:-

Our country has greater prospect to exploit rice as it is the dietary staple of India and Asia, its improvement gives good health to rice eaters. In arsenic affected regions rice assimilates much more arsenic from soils than other grain crops as it is cultivated anaerobically, rather than aerobically. Anaerobic cultivation leads to much greater arsenic mobilization, Unfortunately, extensive areas of land in rice producing regions have been contaminated through irrigation of paddy fields with ground water elevated in arsenic and through contamination from wastewater from base and precious metal activities. The genetics of arsenic uptake and accumulation has been very less studied in plants as compared to animals and human being. Naturally occurring resistance to high soil arsenic has been observed in some species, which has shown to be caused by the reduction of phosphate as well as arsenate uptake The response of 12 rice varieties to 13.3 μ arsenate was tested. Replication of beakers each containing 10 plants was used for both control and treatment. The 40 pair-wise comparisons of beaker reveals a regression of 94% indicating that the vast majority of variance was between individual plants in beakers, rather than between beakers .The variance was confirmed by three-way analysis of variance (factors: genotype, treatment) which indicate that variance and its interaction with the other factors was an order of magnitude lower than the error variance calculated by dividing its root length by the average root length of all 12 control plants. I propose to conduct field trials to determine the productivity of currently grown 12 local cultivars and improved varieties effect and compare them to know the productivity of different varieties that are most suitable for arsenic contaminated soils. Then farmerswere made aware about the most promising varieties and distributed seed and requested them to grow that variety so that people will be less effected by arsenic causing diseases. Familiarizing these improved arsenic resistant varieties will be also done by publishing papers in good journals conducting Conferences, seminars, workshops, with good methods of imparting training. I will train 30-40 farmers by selecting and making group of 8-10 farmers from two /three villages in 6 days in the field of selection of seed use of good quality, variety, plantation of nursery, cultivation, etc. use of equipments, in correct way tools, after harvest technology like storing of seed and grain scientific way of storing so that the seed will remain viable for long period and give good yield when grown. Secondly, food quality improvement. Farmers will be taught and made aware about the affect of arsenic how to reduce and how to taste the arsenic content, by Use ofMachinesdetectionof arsenic poisons in food by: GAS-01.

Objectives:-

1. ToScreen best suitable Arsenic Tolerant Rice variety from available arsenic tolerant varieties which can be grown in Kockrajhar Assam and West Bengal
2. To compare the difference in the amount of Arsenic present in all varieties under study and find out the best in respect of less arsenic amount and yield quality and quantity
3. To compare the Quality and Quantity of yield produced by varieties under study Popularize among local people.
4. To reduce Arsenic intake and prevent Arsenic borne diseases.

Methodology:-

Twelve rice genotypes, were grown in soil (available P- 60 mg/kg), experimental Farm, and soil (available P< 3.50 mg/kg) of research station .Recommended fertilizer dose of NPK was applied for plant sample with three replications for each line . For Arsenic physical chemical measurement Soil samples were collected from the three different points of soil surface (0-20 cm) from the seed Research Farm at Chakdah in Kalyani. This soil was contaminated previously with arsenic through urban sewage sludge. The samples were mixed, transferred to the laboratory, passed through 2 mm sieve and used for physical-chemical and microbial analysis. One gram of soil sample was placed in the nickel plate that already covered its bottom with NaOH. Heated the Nickel plate in order to fully melt NaOH and mixed with soil (alkaline digestion). After cooling, the nickel plate was immersed in HCL (0.5 N) and waited in order to digest slowly then the amount of arsenite was measured. To measure arsenic the spectrophotometer method was used along with a reagent called Leuco malachite green (LMG). one replicate beaker containing 15–20 seedlings at six concentrations of arsenate was used to characterize the dose–response for varieties The data for each plant in a beaker was averaged and the standard error was calculated. In this method arsenic reacts with Potassium iodate (KIO_3) in the acidic environment and iodine was released. Released iodine oxidizes LMG to MG and changes the color to malachite green. Detection range of arsenic concentration in this method is 0.09-0.9 micro g/ml. The MG dye shows maximum

absorption at 617 nm. Amplification was carried out with the reaction condition of 94oC for 5 minutes of initial denaturation followed by 35 cycles each of denaturation at 94oC temperature for 45 seconds, annealing at 58oC and polymerization and PCR products were size fractionated in 1 % Agarose gels and stained with ethidium bromide and documented. Experimental Design Seeds collected from BCKVV seed Research Farm Kalyani, West Bengal (India), were surface sterilized using 10% H_2O_2 for 30 s and washed with Milli Q water. Seeds were germinated on moist pre-sterilized blotting sheets in a tray, placed in seed germinator for 6 days at 25°C, relative humidity was 65%. After 7 days, 50 uniform size seedlings were selected and placed in 150 ml beakers, covered with black sheet, containing 100 ml of 100% Hewitt nutrient medium, prepared in Milli-Q water (pH 6.8–7.0) and grown for another 10 days under light intensity 210 μM $cm^{-2}s^{-1}$ (16/8 h; day/night). 10 days old plants were provided As^V (25 and 50 μM) using the salt Na_2HAsO_4 and SA (100 μM) in the nutrient medium and grown for 7 days.In experiment 1 one replicate beaker containing 15–20 seedlings at six concentrations of arsenate will be used to characterize the dose–response for varieties Azucena and Bala. The data for each plant in a beaker will be averaged and the standard error will be calculated.In experiment 2The response of 12 rice varieties to 13.3 μ arsenate will be tested. In order to estimate sources of variation, two replicate beakers each containing 10 plants will be used for both control and treatment. The 40 pair-wise comparisons of beaker will revealed a regression of 94% indicating that the vast majority of variance will be between individual plants in beakers, rather than between beakers The variance will be confirmed by three-way analysis of variance (factors: genotype, treatment and replicate beaker) which will indicate that variance due to replicate beaker and its interaction with the other factors will be an order of magnitude lower than the error variance. The tolerance values present represent the average and standard deviation of arsenate tolerance index for each plant calculated by dividing its root length by the average root length of all 12 control plants (from two beakers).

Results Achieved:-

I collected seed of Local and improved varieties which are Arsenic tolerant like 1.)NAYANMONI, 2.)GB-1, 3.)4986, 4.) 4595, 5.)White Miniket, 6.)Jaya 7.) Muktoshri also called IET 21845, 8.) BRII, 9.)BR 22, 10.) BRRIDHAN 49, 11.)BHUTMURI, 12.) KUMARGORE from Chinsura and Kalyani Seed Farm and bought other materials required for my experiment. I went to Kalyani of Nadia district and Kokrajhar Assam, Visited fields choose some farmers and field workers to work according to my experiments. I trained them how to do soil testing and perform replication test and also gave them Arsenic tolerant seeds of 12 varieties under study. The variety 4087muktoshri also called IET 21845, was developed by selection method jointly by rice research station Chinsura at West Bengal and NBRILucknow, and was successfully commercialized and is used at large. But the preliminary results in my experiment shows Arsenic affect in plant growth was found to be less in cv Jaya , cv BRRIDHAN- 49 cv 4595 and cv 4986 than 4087 muktoshri and among these four varieties 4986 is found to be the best (table 1). My experiments are not very scientific due to Covid -19. I need to repeat these experiments again and conduct scientific analysis from the lab.

Table 1:- Comparison of seed quality by germination test in the field and in the lab was done and agronomy characters are measured and compared to find the arsenic resistant variety.

VARIETY	EXP 1	EXP 2	EXP 3
1 NAYANMONI	===	IIII	++
2 GB-1	===	IIII	++
3 cv 4986	============	IIIIIIIIII	+++++++++++
4 4595	======	IIIIII	+++++++
5 White Miniket	==	IIII	++
6 Jaya	======	IIIII	+++++
7Muktoshri	===	IIII	++
8 BRII	===	IIII	++
9 BR 22	===	II	++
10 DHAN 49	=====	IIIII	+++++
11 BHUTMURI	==	IIII	+++
12 KUMARGORE	==	III	++

Table 2:- Soil sample were collected from 7 field of Chakdha, of Nadia district of West Bengal.

S No.	Name	Village	Dist	Dag No	Arsenic in th soil sample	Mineral & Salt	PH	Carbon %	Phospho us	Potassi m
1	BadshaMonda	Sajerdhar	Nadia	Sajerdhar	.3166	0.11	8.07	Low	Low	Low
2	BadshaMonda	Chasadhopapaa	Nadia	Sajerdhar	.3174	0.14	8.14	Low	Low	Low
3	KRISHNA GOPAL DAS	MOHISHDAN GA	Nadia	PURBODIPEF PHALI	.3175	0.19	8.22	Low	Low	Low
4	KRISHNA GOPAL DAS	MOHISHDAN GA	Nadia	PASCHIMDIF ERMOMI	.3168	0.12	8.2	Low	Low	Low
5	MADHAV DAS	MOHISHDAN GA	Nadia	DHIJANDASI R	.3173	0.1	8.24	Medium	Medium	Low
6	MADHAV DAS	MOHISHDAN GA	Nadia	16 SATAK	.3165	0.13	8.31	Medium	Medium	Low
7	MADHAV DAS	MOHISHDAN GA	Nadia	ACHEYDERJ AMIN	.3179	0.18	8.15	Low	Medium	Low

Improved technique which helps in reduction of arsenic uptake if followed, then if a 10% reduction of Arsenic is seen in rice grain, it could save hundreds of thousands of lives from health problems. I will work efficiently when the movement restrictions for the entry in the research organizations and lab will open where arsenic analysis can be done and I shall confirm about my result.

Discussion:-

To know the harmful effects of arsenic and to control arsenic uptake in Plants especially Rice, so that more and more people are saved from being sick by different serious diseases caused due to presence of arsenic. Chronic arsenic poisoning is due to continuous exposure to arsenic compounds, like arsenides, sulfides, and sulfosalts in natural environment which leads to an accumulation of arsenic in the body and causes many harmful diseases to humans, plants and animals as high level of Arsenic causes chromosomal damage enabling them to participate in cell division and restrict in growth of cells. During the tenure of my project varietal screening for arsenic reduction in the grain was studied. After Screening 12 rice cultivars were analyzed for arsenic accumulation ability in straw and grain with and without hull. In Straw accumulation was found significantly higher than grain. Short and long grain aromatic rice accumulates lesser amount of arsenic. Less variability between phenotypic variations suggested the influence of Arsenite remain as the predominant inorganic form found in xylem sap of rice plants. Bio remediation work was also studied for arsenic control in rice plants with micorhizal fungi. There are many varieties produced which are high yielding short duration, long grain, resistant to pest and aromatic but screening of arsenic tolerant variety is very important right and easy method to control Arsenic. In this project I am trying to do the same and after screening my most important objective is to spread to rice growers about the diseases caused by Arsenic name of the variety best suited in the specific area with the arsenic tolerant character.

Acknowledgement:-

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