

BREEDING EFFORTS FOR DEVELOPMENT OF CANOLA GRADE MUSTARD VARIETY IN FIELD MUSTARD (*Brassica rapa*)

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Abstract

Brassica rapa is the main oilseed crop in Bangladesh and development of canola grade *B. rapa* variety is a priority research in Bangladesh. The present research was undertaken with a long term goal to develop canola grade *B. rapa* variety in Bangladesh. Six Canadian canola grade double zero genotypes of *B. rapa* were crossed with four Bangladeshi popular varieties e.g. Tori-7, Maghi, BARI Sharisa 14 and BARI Sharisa 17 to develop 24 F₁ hybrid populations. For transferring the low erucic trait from Canadian lines to Bangladeshi cultivars, backcrosses were also performed. The F₁ hybrids were evaluated for their saturated and unsaturated fatty acid compositions and yield contributing traits. The analysis of variance showed highly significant variation among the F₁ and BC₁F₁ populations. Among the 24 hybrids, the lines G1, G7, G14, G14, G16, G17, G18 and G19 were selected as promising lines as these lines had higher values of the yield and yield contributing traits. These F₁ lines were selected and advanced to F₂ generation through self-fertilization and were also used in backcross breeding to develop BC₁F₁. Among the hybrids, the desired negative heterosis effects for early maturity (90-95 days) were found in the hybrids G4, G5, G6, G7, G13 and G17, while the hybrids G17, G18, G19, G20 showed the highest significant heterosis for yield, and the hybrids G17 and G18 had the highest harvest index. The results suggested elite recombinant lines of early maturity and high yielding could possibly be obtained from the segregants of these hybrid lines. The fatty acid composition analysis unraveled that the hybrids viz. G3, G4, G5, G9, G12, G17, G20 and G23 had lower erucic acid (<20-22%), but higher oleic (32-34%) and higher linoleic acid (22-24%), linolenic acid (9-11%) contents suggested that these lines could possibly produce low erucic acid plus high oleic linoleic, and linolenic acids in the segregating generations. Interestingly, some intercrossed F₂ lines were found having low erucic acid (<2%), but higher oleic acid (>50%) with early maturity (90-94 day) suggesting the breeding lines were very promising. Thus, the selected promising breeding lines could be utilized for developing early matured and high yielding having low erucic acid and high mono- and poly-unsaturated fatty acid compositions.

Keywords: short duration, canola-grade, breeding lines, high oleic acid, *Brassica rapa*

DEVELOPMENT OF CANOLA GRADE INDIAN MUSTARD (*Brassica juncea*) VARIETY TO MEET THE EDIBLE OIL SECURITY AND CLIMATE CHANGE CHALLENGES IN BANGLADESH

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Abstract

Erucic acid >2% in mustard oil is considered as unhealthy as edible oil and anti-nutritional for human consumption. The existing all mustard varieties of Bangladesh contain 40-48% erucic acid, which is a big concern for food and nutritional security and safety of the country. Hence, to develop canola grade mustard variety, six Bangladeshi *Brassica juncea* mustard variety were crossed with a canola grade double zero *B. juncea* line in 7×7 half diallel fashion. The developed 21 F₁ hybrids along with their parents were evaluated for yield contributing traits and fatty acid compositions. High narrow sense heritability was observed in days to pod maturity, while plant height, days to first flowering and seeds per siliquae showed moderate narrow sense heritability. The parental lines, P1, P3 and P4 were found as the best general combiner for earliness and dwarfness and, P2 and P7 showed the best combiner for yield contributing traits. Whereas, the hybrid lines, G3, G11 and G13 indicated the best specific combiners for yield attributes, and the crosses, G6, G17 and G21 found for early maturity. The hybrid G3, G5 and G17 manifested the highest heterosis for early maturity over the check variety BARI sharisha 11. In the fatty acid compositions analysis, the crosses G19-S4, G5-S1 and G21-S1 contained low erucic acid. In hybrids, total saturated fatty acid and mono-unsaturated fatty acid was ranged from 10.81% to 16.53% and 40.60% to 59.18%, respectively. The highest ratio of oleic acid (ω-9) to linoleic (ω-6) acid was found in P6, G5-S1 and G19-S4. Moreover, P6, G19-S4 and G19-S2 showed the highest ratio of linoleic (ω-6) to linolenic (ω-3) acid. The selected F₁ hybrid lines were further backcrossed to the selected Bangladeshi parents to reduce the growth duration and the seven types of BC₁F₁ and BC₂F₁ lines were developed. Altogether, the hybrids viz., G4, G5, G7, G11, G17, G19, G21 and lines of BC₁F₁, BC₁F₂ and BC₂F₁ could be utilized to develop early matured, high yielding low erucic acid containing improved mustard variety.

Key words: low erucic acid, canola-grade, saturated and unsaturated fatty acid, breeding lines, climate change, *Brassica juncea*

STUDIES ON VETERINARY ANTIBIOTIC RESIDUES AND RESISTANCE IN FARM PRODUCES TO ENSURE SAFE AND QUALITY FOOD OF ANIMAL ORIGIN; A SAFE FOOD CONCERN

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Abstract

Antibiotic residues in farm products are widely considered as a significant cause of antibiotic resistance. However, no comprehensive work has been documented to date on this issue in Bangladesh. Therefore, this study aimed to explore residual antibiotics and resultant Antimicrobial Resistance (AMR) in farm produces. A total of 1000 samples (300 meat samples, 300 milk samples and 400 eggs samples) were collected from different parts of the country and analyzed by European Four Plate Techniques, Enzyme-Linked Immunosorbent Assay (ELISA) and Antibiotic Residue E-Reader. Microbial loads in farm produce were determined by conventional cultural methods. Antibiotic resistance of the isolates was determined by Kirby-Bauer disc diffusion method using 10 most commonly used antibiotics in veterinary medicine. As high as 37%, 59% and 75.70% of meat, milk and egg samples, respectively were found qualitatively positive to contain residual antibiotics. Quantitative analyses by ELISA showed that levels of all antibiotics residue except penicillin) in farm produces were below maximum residue limit (MRL). Salmonella, E. coli and Staphylococcus aureus were isolated from most of the samples. Isolated pathogenic organisms had multi drug resistance. The present study findings showed that food of farm origin in Bangladesh contains residual antibiotics though most of them are below the Maximum Residue Limit (MRL). However, still these residual antibiotics may contribute to the development of antibiotic resistance in zoonotic organism that may threaten food safety and public health. Present study revealed that microorganisms are getting resistance against essential antibiotics that in turn might compromise public health in great extent. Therefore, the study suggests to ensure judicious use of antibiotics in all cases.

Keywords: antibiotic resistance, farm products, pathogenic bacterial strains

MOLECULAR DETECTION OF *Ralstonia solanacearum* (Rs) RACE(S)/ PHYLOTYPIC CAUSING BROWN ROT OF POTATO

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Abstract

Prevalence of significant pathogen *R. solanacearum* causing a potential disease brown rot of potato studied in the major potato growing districts of Bangladesh viz. Munshiganj, Chandpur, Tangail, Narayanganj, Jamalpur, Domar, Patuakhali, Rangpur, Bogra, Shariatpur, Meherpur, Joypurhat and Dinajpur. A total of 133 samples were used for isolation on Kelman's (1954) TZC agar medium, these strains yielded typical virulent type colonies, which were cream coloured, irregularly shaped, highly fluidal with pink pigmentation in the centre. Out of tested isolates, 125 (ie.94%) found positive for presence of *R. solanacearum*. Among the isolates, thirty nine isolates were tested for race, biovar and phylotype study based on a preliminary hypersensitive reaction test. Race and biovar of the test pathogens were determined following standard procedure described by EPPO, 2004; & Kumar, 2017 *et al*; and Goszczynska, *et al.* 2000; & IPDN, 2014. It was observed that all thirty nine tested isolates expressed as race 3 while in bovar test thirty seven showed as biovar III except two showed biovar I. Total genomic DNA of all the strains was extracted and subjected to PCR amplification using the *R. solanacearum* specific universal primer pair 759/760. DNA-based methods have provided powerful tools to identify and detect microorganisms with high sensitivity and specificity. PCR assay amplifies the DNA of bacterial pathogens, targeting the species-specific sequences in their genome. In the present study an efficient DNA isolation protocol and PCR based detection of bacterial wilt pathogen in soil, seed and infected plant materials has been used. The specific primers 759f/760r was successfully used to detect *Ralstonia solanacearum* from different sources and predicted 280-bp DNA fragment was obtained. In conclusion, the PCR-based detection method using *R. solanacearum* specific primer offers a rapid and sensitive method for unambiguous detection of this pathogen in soil, seed and infected potato plant materials. The pathogen *R. solanacearum* was consistently isolated from storage potato stored in cold storage and in farmer's storage system. Significantly higher incidence of *R. solanacearum* occurred in farmer's storage compared to cold storage system. Again, in both storage systems the incidence increased significantly with the time of storage period. This indicates that this significant pathogen can well survive in the stored potato and with the duration of storage the infection also increases.

Keywords: molecular detection, race, PCR, primer, genomic DNA, *Ralstonia solanacearum*

**MORPHOLOGICAL VARIATION AND MOLECULAR
CHARACTERIZATION OF *Magnaporthe oryzae* AND SCREENING RICE
GERMPLASMS AGAINST RICE BLAST**

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Abstract

Experiments were conducted at Mycology Laboratory, Department of Plant Pathology, Sher-e-Bangla Agricultural University, Dhaka from July 2018 to June 2021 to study morphological and molecular characterization of rice blast pathogen *Magnaporthe oryzae* (Mo) that has become a major factor limiting rice yield throughout the world. Initially survey was done in twenty (20) rice growing districts of Bangladesh and rice blast samples (infected leaf, neck and node) were collected. Five different media including Water Agar (WA), Potato Dextrose Agar (PDA), Potato Sucrose Agar (PSA), Rice flour Yeast Agar (RfYA) and Oat Meal Agar (OMA) were used to compare growth of Mo. Colony characters like growth character, color, surface structure and shape of 100 Mo isolates were recorded in OMA. Isolates were pathogenic to US2 and BRRI Dhan 28. In molecular identification (ITS rDNA gene) PCR using primer pairs ITS1/ITS4 yielded approximately 600 bp band of amplification product for representative isolates of *Magnaporthe*. Among the five different growth media highest mycelia growth rate was observed in OMA and lowest in WA. Colony color of all the isolates was whitish, greenish, brownish, white gray, light brown etc. Six (6) resistant germplasms were screened against Mo and would be useful in future rice blast resistant variety development program.

Keywords: variation, *Magnaporthe oryzae oryzae*, screening, rice genotype, resistant, blast

RT-PCR BASED CLONING AND SEQUENCING OF POTATO LEAF ROLL VIRUS-COAT PROTEIN (PLRV-CP) GENE FOR CHARACTERIZATION AS A BANGLADESHI PLRV ISOLATE AND ITS PHYLOGENETIC ANALYSIS

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Abstract

An experiment was conducted in Molecular Biology and Plant Virology Laboratory under the Department of Plant Pathology, Sher-e-Bangla Agricultural University, Dhaka-1207, Bangladesh. Total RNA was extracted from Potato leaf roll virus (PLRV) positive leaves and complementary DNA (cDNA) were synthesized from total RNA. Reverse transcriptase polymerase chain reaction (RT-PCR) based detection conditions were optimized by using coat protein (CP) gene specific primers. In PCR amplification cDNA and in nucleotide sequencing PCR product was used as a template. A 346 bp amplicon of PLRVCP gene was amplified and amplified gene region was sequenced. The expected nucleotide sequence of amplified PLRV-CP gene showed 95 to 98% homology when compared with the isolates sequences reported in Gene Bank database. This explored novel PLRV-CP gene was characterized as a PLRV Bangladeshi isolate (Accession number, Bankit 2274496, MN605963). PLRV-CP gene protein modeling was carried out using Expert Protein Analysis System (ExPaSy), DNASTAR's protein tools server used for 3D protein modeling. Phylogenetic analysis was also carried out, the tree was made by using MEGA 4.0 software and maximum parsimony method was selected to construct phylogenetic tree. The RT-PCR based molecular technique optimized in this study, would be a useful for early detection, epidemiological studies of PLRV as well as in seed tubers certification program and the novel hyper variable sequenced region of PLRV-CP gene will be useful in pathogen derived resistance breeding program against the PLRV local strain.

Keywords: potato, PLRV-CP Gene, PCR-Based Cloning, PLRV-Bangladeshi isolate.

DETERMINING THE OCCURRENCE AND DISTRIBUTION OF VIRUSES CAUSING DISEASES ON PUMPKIN FOR DEVELOPING EFFECTIVE MANAGEMENT STRATEGIES

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Abstract

Pumpkin (*Cucurbita moschata*) belongs to the family Cucurbitaceae, is an important crop in the tropical and subtropical regions of the world. Due to high content of vitamin A, it is very nutritious and can play a vital role in meeting the vegetable shortage and nutritional problems. Diseases caused by viruses have a negative effect on the yield of pumpkin and other cucurbit crops. A survey was conducted to collect virus infected leaf samples of pumpkin to find the occurrence and distribution of viral diseases of pumpkin from three districts of Bangladesh. A field experiment was also conducted to determine specific symptom (s) associated with *Cucumber mosaic virus* CMV of pumpkin to aid visual diagnosis and serological detection and to find suitable management strategies for pumpkin infecting CMV diseases. The experiment was conducted during October'2017 to April'2018. The experiment was laid out in RCBD with three replications in the field. The seedlings with two cotyledons were inoculated with CMV and then transplanted in main field for management this virus. During survey, ten (10) characteristics symptoms were recorded as indicator of virus infection through visual observation. Among these symptoms, four symptoms showed positive to serological test by using CMV antiserum. By observing color of ELISA test, it was concluded that mosaic, yellow mosaic, chlorosis and hardy leaves symptoms showed positive to CMV. In field management experiment, CMV incidence and severity both showed the lowest in treatments T₁ (Inter crop coriander) which was 21.10% and 11.11%, respectively whereas disease incidence (%) and disease severity (%) both were maximum in T₆ (Control) and which were 70.84(%) and 26.67(%) respectively. In case of growth and yield attributes, there were significant variations found in all attributes. Thus, in this study the effective management was intercropping by coriander. A negative relation between CMV disease severity (%) and yield (in kg) per treatment indicated that with the increase of disease severity (%), yield of pumpkin decreased. On the contrary, positive relation between CMV disease severity (%) with aphid population (no.) which indicated that with the increase of aphid population (no.), infection rate is increased. Inoculated CMV was identified in pumpkin leaves by visual observation and six (6) major categories of viruses symptoms were found in field viz. mosaic, yellow mosaic, fern leaf, chlorotic spot, leaf distortion and hardy leaves by visual observation. Among them, in serological test, barrier crop maize, yellow trap, chemical Malathion 57 EC and control treatments of pumpkin were infected with CMV which symptoms categories were mosaic, yellow mosaic, leaf hardening, curling and chlorosis shown positive during serological test by using CMV antiserum.

Keywords: occurrence, distribution, identification, serology, cmv, pumpkin, aphid population, management strategy

METHOD DEVELOPMENT FOR COMB HONEY PRODUCTION

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Abstract

An experiment was conducted in a litchi orchard at Iswardi of Pabna district in the year 2021 in Bangladesh to develop feasible comb honey production at colony level. Twenty number of strong bee colonies were used to develop comb honey inside a Super chamber on each strong bee colony. Litchi orchard was used as a source of nectar producing plants. Four methods were used to harvest comb honey i.e. comb cassette method, bottle with wax foundation method, bottle without wax foundation method and only frame in super as untreated control. Honey collection from the super chamber of bee hive was the highest (1.702 kg/frame) in only frame in super (control) in comparison to all other treatments viz. comb cassette method, bottle with wax foundation method and bottle without wax foundation method in terms of weight per unit in super chamber. But in terms of area per super chamber of bee hive the highest (53.546 kg/super) yield of honey was obtained from the comb cassette method utilized bee hives which is followed by control (30.638kg/super), bottle without wax foundation (11.433 kg/super) and bottle with wax foundation (6.405kg/super), respectively. It was observed that in comb cassette method honey yield increases by 74.77% in comparison to untreated control method. It was also revealed that profitability can be increased by double fold (2.03) by adopting the comb cassette method in litchi blooming period from a honey bee colony.

Key words: comb cassette, honey yield, profitability

UPDATING HYDROPONIC CULTURE OF TOMATO AND UPSCALING OF HYDROPONIC TECHNOLOGY DEVELOPED DURING THE EARLIER STUDIES WITH SMALL SCALE PUBLIC PRIVATE PARTNERSHIP

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Abstract

Hydroponic culture is one of the important climate smart approaches for vegetable production in Bangladesh. But it needs upscaling and dating for commercial use. Therefore, a series of experiments are conducting from October 2020 to 2023 to update hydroponic culture of tomato funded by 4th Phase Bangladesh Academy of Science-United States Department of Agriculture (BAS-USDA) Endowment Program. One of six experimental results has been discussed here like effect of nutrient solution strength on tomato hydroponic culture. Nutrient solution and its nutritional compositions may have the effect on growth and fruit quality attributes of tomato. To avoid the build-up of toxins, mineral deficiencies, nutrition abnormalities, or the spread of disease, producers should use optimum level of nutrient solution. Therefore, the present experiment was conducted to identify a suitable strength of nutrient solution for cherry tomato in hydroponic system. Treatment considered six levels of nutrient solution [*viz.*, S₁: ½ strength Rahman and Inden (2012), S₂: ¾ strength Rahman and Inden (2012), S₃: Full strength Rahman and Inden (2012), S₄: ½ strength Hoagland and Arnon No. 2(1940), S₅: ¾ strength Hoagland and Arnon No. 2 (1940) and S₆: Full strength Hoagland and Arnon No. 2 (1940)] and two varieties [*viz.*, V₁: Local market cherry tomato (red), V₂: Irelands cherry tomato (yellow)]. Growth and yield contributing characters, quality parameters, physiological traits and biochemical composition were analyzed. The maximum plant height, number of leaves per plant, first flowering, number of flowers per cluster, number of fruit per cluster, number of cluster per plant, average individual fruit weight and average cluster weight per plant were found in S₃. Meanwhile, V₂ performed better in respect of plant height, number of leaves per plant, first flowering, number of flowers per cluster, number of fruit per cluster, number of cluster per plant, average individual fruit weight and average cluster weight per plant. Therefore, cherry tomato cv. V₂ can be cultured in hydroponic system with applying S₃ (Full strength Rahman and Inden nutrient solution).

Keywords: soilless culture, nutrient solution, growth, fruit quality and tomato

DEVELOPMENT OF SUSTAINABLE HYDROPONIC TECHNIQUES OF CAPSICUM UNDER CHANGING CLIMATE IN BANGLADESH

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Abstract

Hydroponic culture provides an instant and long-term solution to the problem of inability to produce vegetables and it allows for uninterrupted year-round vegetable production. But the disadvantages of hydroponics are high costs of capital and energy inputs, and high degree of management skills required for successful production in Bangladesh. Therefore, it is necessary to develop a low-cost and simple hydroponic system of crops like sweet pepper that can be increasingly popular in Bangladesh. Three experiments were conducted from July 2018 to March 2021 to develop a low-cost and simple hydroponic cultivation system of sweet pepper funded by Social Science Research Council (SSRC), Planning Division, Ministry of Planning, and Government of Bangladesh.

Firstly, different concentrations of nutrient solution were tested for sweet pepper in semi-greenhouse. A suitable concentration of Rahman and Inden (2012) solution was identified for sweet pepper. Sweet pepper was performed better in respect of quality and higher yield when applied $3/4^{\text{th}}$ strength of Rahman and Inden (2012) solution. This study indicated that sweet pepper can be grown successfully by applying Rahman and Inden (2012) as mentioned above strength in soilless system in the tropical areas like Bangladesh.

Secondly, cow dung slurry as an alternative liquid fertilizer source was used with Rahman and Inden (2012) nutrient solution in soilless culture of sweet pepper. It is a less expensive alternative liquid fertilizer source as an addition in the standard solution. It can reduce crop production cost. But without testing its effect on growth, quality, and yield, it may not be suitable for use an alternative fertilizer in a sustainable production system. In this study, cow dung slurry 400 ml + $3/4$ strength standard nutrient solution was suitable for sweet pepper hydroponic culture with higher yield of high-quality produces. Therefore, it suggests that cow dung slurry, an alternative liquid fertilizer source, can be used in soilless culture.

Finally, a low-cost and simple (LCS) hydroponics structure was developed for growing sweet pepper in Bangladesh. It was easy to make and low-cost that can be used in commercial production of sweet pepper in Bangladesh.

Keywords: soilless culture, low-cost hydroponics, nutrient solution and capsicum

APPLYING BIOCHAR AND DIFFERENT FORM OF NITROGEN: BE A GOOD AGRICULTURAL PRACTICE FOR BETTER YIELD AND PROCESSING QUALITY OF POTATO

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Abstract

Purpose: Produced tubers with inferior quality are the main bottleneck for exporting surplus amount of potato to the importing countries. Applying nitrogen as prilled and super granule urea along with biochar may improve the yield and processing quality of potato. To generalize a partial solution, the study was conducted to find out the efficiencies of N forms and biochar towards the improvement of the processing quality of potato for export.

Research Method: The experiment comprised two factors. Factor A: Nitrogen form (2): Prilled Urea (Up) and Urea Super Granule (US), and Factor B: Biochar level (6): B0-Control, B1- 2 t/ha, B2- 4 t/ha, B3- 6 t/ha, B4-8 t/ha, and B5- 10 t/ha. The experiment was laid out in a split-plot design with three replications.

Results: Nitrogen form and/or biochar levels had shown significant influence on most of the parameters. The maximum tuber yield of potato (37.9 t ha⁻¹) was observed from UsB5 which was statistically similar to UsB4. The maximum dry matter content of tuber (21.8 %) and specific gravity of potato (1.098 g/cc) were observed from UsB4. So, it may be concluded that the application of urea super granule (US) plus biochar B4 (8 t/ha) was found best combination for maintaining optimum yield and better processing quality of potato.

Findings: Application of biochar improved the soil organic carbon status (data not shown) and exhibited better potato yield and qualities. Urea super granules (USG) are much economic and environmental friendly

Keywords: biochar, urea form, dry matter, specific gravity, yield

ADOLESCENTS' NUTRITION LITERACY AND HEALTH-RELATED BEHAVIOR: THE EFFECT OF COMPUTER-MEDIATED COMMUNICATION MEDIA

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Abstract

More and more young people are using the Internet for education and entertainment, and the Internet influences them. This study looks at how 13- to 19-year-olds in Bangladesh describe how they use social media to get information about nutrition. It also looks at how the information they get supports their health-related behavior. We used research methods, a survey, and online and face-to-face interviews. We analyzed 345 valid and complete responses using Smart PLS-based Structural Equation Modelling (SEM). We found that the teenagers had a satisfactory level of nutrition literacy, and that social media can promote health-and-nutrition-related content. We also found that the nutrition literacy of teenagers was unrelated to their behavior. Instead, their choices of content, their sense of altruism, and different forms social support influence the way they use media. These factors also reflected and reinforced their attitudes to health. This study concludes with recommendations for influencing the nutrition- and health-related behavior of teenagers.

Keywords: adolescent, nutrition literacy, health behavior, computer-mediated communication, social media.

DESIGNING CLIMATE RESILIENT DEVELOPMENT PATHWAYS TOWARDS THE SUSTAINABILITY OF COASTAL AGRICULTURAL SYSTEMS

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Abstract

Developing climate resilient pathways have become an optimal strategy to achieve sustainable development. The goal of the study is to design climate resilient development pathways (that are, development trajectories that combine adaptation and mitigation to realise the goal of sustainable development) to catalyse the sustainability of coastal agricultural systems (CAS). Author developed resilient pathways by using four sequential steps (i) identifying climatic and non-climatic risks of CAS; (ii) determining synergies and trade-offs between adaptation, mitigation and agricultural development; (iii) developing strategies for effective institutional management; and (iv) designing development trajectories that combine productivity, adaptation and mitigation of CAS. Key research instruments included key informant interviews (KIIs), household surveys, focus group discussions (FGD) and participatory workshops in four upazilas of two districts, using structured questionnaires. The results showed that soil salinization, impeded drainage, and coastal flooding were extremely high risks to CAS. Researcher determined synergies and tradeoffs by exploring farmers' activities and practices. To arrange the complicated information linked to CAS, the DPSIR (Drivers, Pressures, States, Impacts and Responses) tool was used. To design pathways, two workshops were organised in two districts. On-farm water harvesting and agroforestry were identified as synergies and converting farming land to shrimp ponds and degrading coastal wetlands as tradeoffs that occur frequently. For developing effective institutional mechanisms four mechanisms were found most important which are; improving organisational learning, engaging key stakeholders, increasing organisational accountability, and enhancing coordination. Conserving and improving coastal natural resources, scaling up climate resilient water management, adoption of diversified farming practices was found to be the best practices for climate resilient development pathways of the CAS in Bangladesh. Major policy implications towards the implementation of climate resilient development pathways were outlined.

Keywords: synergy, tradeoffs, climate resilient development, adaptation, mitigation, coastal zone

SPLIT APPLICATION EFFECTS OF NITROGEN FERTILIZER ON GROWTH AND YIELD OF QUINOA (*Chenopodium quinoa* Willd.)

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Abstract

The project was carried out by setting an experiment at the research field of Sher-e-Bangla Agricultural University, Dhaka during the period of November to May, 2020-2021 to study the split application effects of nitrogen fertilizer on growth and yield of Quinoa (*Chenopodium quinoa* Willd.). The trial comprised seven split application methods of urea fertilizer viz. (i) 1/3rd urea top dress at 25 DAS + 1/3rd urea top dress at 45 DAS -T₁; (ii) 2/3rd urea top dress at 25 DAS - T₂; (iii) 2/3rd urea top dress at 45 DAS -T₃; (iv) 1/3rd urea top dress at 25 DAS + 1/3rd urea as foliar at 45 DAS -T₄; (v) 1/3rd urea as foliar at 25 DAS + 1/3rd urea top dress at 45 DAS - T₅; (vi) 2/3rd urea foliar at 45 DAS -T₆ and (vii) 1/3rd urea as foliar at 25 DAS + 1/3rd urea as foliar at 45 DAS - T₇. One third urea was applied as basal dose for all the treatments. The experiment was laid out in randomized complete block design with three replications. Plant height, number of leaves plant⁻¹, dry matter plant⁻¹, root length, shoot length, SPAD value, number of inflorescence plant⁻¹, 1000-seed weight, grain yield, straw yield, biological yield and harvest index were compared for different treatments. Results revealed that split application of 2/3rd urea in different method did not significantly influence most of the growth and yield parameters except plant height at 35 DAS, number of leaves plant⁻¹ at 50 and 65 DAS and harvest, dry weight plant⁻¹ in all studied durations, root and shoot length at 40 DAS and SPAD value at 50 DAS. Foliar application of 1/3rd urea at 25 DAS and rest 1/3rd top dress at 45 DAS showed lowest performance. Though the seed yield was not influenced by split application of urea fertilizer but T₆ (1/3rd urea as basal + 2/3rd urea foliar at 45 DAS) and T₂ (1/3rd urea as basal + 2/3rd urea top dress at 25 DAS) gave 1.37 t ha⁻¹ and 1.33 t ha⁻¹ yield that was 17.09% and 13.68% higher, respectively compared to the present practice of T₁ (1/3rd urea as basal + 1/3rd urea top dress at 25 DAS + 1/3rd urea top dress at 45 DAS) having yield of 1.17 t ha⁻¹.

Keywords: top dressing, foliar spray, urea, yield, quinoa.

GENERATED TECHNOLOGIES FOR WHITE MAIZE CULTIVATION IN BANGLADESH

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Abstract

A 3-year project was implemented jointly by Sher-e-Bangla Agricultural University, Dhaka; Agrarian Research Foundation, Dhaka; and Bangladesh Wheat and Maize Research Institute, Dinajpur during 2015 to 2017 to find out better performing varieties out of 47 and generate technologies for white maize production in Bangladesh under a project named 'Collection, Evaluation and Introduction of White Maize for Consumption in Bangladesh' using the funds of Krishi Gobeshona Foundation. The project was implemented by Sher-e-Bangla Agricultural University, Dhaka and WRSS, Dinajpur) both on stations and in farmers field of six different agro climatic zones (Dhamrai, Rangpur, Dinajpur, Barisal, Bandarban, Nilphamari). In Rabi season, the varieties (PSC-121, Changnuo-1, Q-Xiangnuo -1, Changnuo-6, Yangnuo-30 , BRAC Uttoron, BRAC-2622, Yangnuo-3000, Shuvra, Yu2, CIMMYT lines 15003,15010, 15009, 15007, 14003, 15006, 15008)) significantly yielded higher (7.160-12.948 t/ha) in Dhaka region in rabi season. At Rangpur, the variety Changnuo-1 produced significantly higher yields showing seed yield range of 6.348-12.165 t/ha). At Bandarban: varieties PSC-121 showed higher seed yields (7.717-9.103 tons/ha), while the CIMMYT lines (14003, 15003, 15008, 15010) produced significantly higher seed yields (13.122-14.074 t/ha). At Dinajpur, the varieties PSC-121, Yangnuo-30 and Changnuo-6 proved to be better giving yield up to 8.61-11.749 t/ha, while the CIMMYT lines 15001, 15003, 15010 and 14003 gave significantly higher yields from 14.373-15.041 t/ha. At Nilphamari, the variety PSC-121 showed the highest seed yield of 10.590 t/ha. At Barishal, PSC-121 and KS-510 produced yields 6.422 and 7.585 tons/ha, respectively. In Kharif season, the variety Yangnuo-3000 and PSC-121 were consistent showing seed yields of 5.353-5.915 t/ha in Dhaka region. Almost in all the regions, using 100-125% of the fertilizer dose as recommended for the HYVs by BARI had significantly higher seed yield (8.284-11.635 t/ha) as compared to lower doses. But in Nilphamari, significantly the highest yield was obtained using 150% more dose. At Dhamrai: Fertilizer dose 125% had the highest seed yield (7.901 t/ha). But at Rangpur fertilizer dose 100-125% had higher seed yield. Planting configuration using row to row spacing from 50 cm x 25 cm were proved to be optimum. Nutritional analyses showed that the local white maize varieties had highest protein content (11.75%) than the exotic and inland HYVs (7.11-8.22%). On an average, white maize had higher

protein content than the yellow ones. Maximum fat content was obtained with Suvra (4.39%), while the fiber with PSC-121 (2.93%), ash with local (1.69%) and carbohydrate with Changnuo-1. The maximum apparent amylose content (AAC) was with Changnuo-1 and Suvra (around 24.5%) while the least in local (6.83%). The highest glycemic index (GI) was obtained with Yangnuo-7 and local maize (71%) while other varieties showed glycemic index a bit over 60%. Leaf clipping trials showed that removal of uppermost three leaves had no significant effect on the yield reduction of maize. Irrigation lesser than four (25DAS+50DAS+75DAS+100DAS) reduced seed yields significantly. Spraying antitranspirant 'Kaolin' at vegetative stage with 1%, while at tasseling stage with 3% increased seed yields significantly as compared to no application. Alternate furrow irrigation reduced seed yield (by 14%) significantly. Seedling transplanting reduced the seed yield by 15% as compared to the direct sown crops (6.035 vs 5.141 t/ha). Results from two different herbicides (aryl triazolinones and Pendimethalin) showed that moistening upper soil layer with a post emergence application of Pendimethalin 1.5 between two adjacent lines yielded the highest (8.817 t/ha). Weeding experiments showed that weeding at 60 DAS and complete weeding treatments had identical seed yields (9.675 and 9.213, respectively).

Key words: generated, technologies, cultivation, white maize, production

SAU PERILLA-1: A PROSPECTIVE OIL SEED CROP FOR EDIBLE OIL PRODUCTION DURING KHARIF-2 SEASON IN BANGLADESH

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Abstract

SAU Perilla-1 (*Perilla frutescens* (L.) Britt.) is a new oil seed crop variety developed by Sher-e-Bangla Agricultural University through introduction and acclimatization in Bangladesh. This variety is well suited to cultivate during the Kharif-2 season (during Monsoon) in Bangladesh to produce edible oil. SAU Perilla-1 has a high oil content, ranging from 38% to 40%. The oil is a nutritious and healthy choice as it has zero Erucic acid but contains high percentage of unsaturated fatty acids (>90%), with Omega-3 fatty acids making up >50% of these unsaturated fatty acids. The crop is also relatively easy to grow, with a short growing season of 70-75 days to harvest from main field. Field trials have shown that SAU Perilla-1 has yield potential of 1.3 to 1.5 tha^{-1} . It was also revealed that farmers can benefit from using the same land with a new cropping pattern comprised of SAU Perilla-1 with other crop varieties such as BARI Sarisha-14 - BRRI dhan-28 - BRRI dhan-48 - SAU Perilla-1 and this practice could lead to improve cropping intensity and income of the farmers as well. Moreover, the crop could easily be cultivated in fruit gardens like papaya, mango, litchi etc. as an intercrop and on fallow land especially slopes of roads and high ways as well. According to the Bangladesh Edible Oil Producers Association (BEOPA), Bangladesh imported around 3.2 million metric tons of edible oil in the fiscal year 2020-21. The country's annual demand for edible oil is expected to rise to 3.8 million metric tons by 2030. This heavy reliance on imported edible oil puts a significant strain on the country's foreign exchange reserves. In this case SAU Perilla-1 has the potential to be a sustainable alternative to supplement the imported edible oils and could contribute to reduce the dependency on imported edible oil in Bangladesh. By 2022 the crop is cultivated in almost 100.00 acres of land over 20 districts in Bangladesh. Thus, the crop is gradually approaching as an attractive option for farmers providing an additional source of income especially during Kharif - 2 season when no other oil crops are not cultivated in Bangladesh. In conclusion, with its high oil content and excellent oil quality, SAU Perilla - 1 would have been appeared as an additional choice of potential and profitable crop for reliable source of domestic edible oil towards reduction of edible oil import volume in Bangladesh.

Keywords: oil seed crop, kharif - 2 season, SAU Perilla-1, Bangladesh

PHYSIOLOGICAL AND BIOCHEMICAL MECHANISMS OF MICRONUTRIENT MEDIATED SALT STRESS TOLERANCE IN SOYBEAN

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Abstract

Like other abiotic stresses, salinity also adversely affects the vital morphological, physiological and biochemical mechanisms of plants and ultimately causes yield reduction. This experiment was carried out to study the morphological, physiological, biochemical, phenotypical and anatomical responses of soybean (*Glycine max* L., cv. BINA Soybean 5) upon exposure to different levels of salinity and to investigate the role of exogenous application of selenium (Se) and boron (B) in mitigating salt stress. Plants were treated with 0, 150, 300 and 450 mM NaCl at 20 DAS and 35 DAS to stimulate salinity. Exogenous application of Se (0.50 μ M Na₂SeO₄) and B (1 mM H₃BO₃) was done individually (Se, B) and combinedly (Se+B) at 20 DAS and continued at three days interval until pod filling stage under normal and saline condition. Plants exhibited a reduction in plant height, shoot fresh weight, shoot dry weight, root fresh weight, root dry weight, number of branches plant⁻¹, number of flowers plant⁻¹, leaf area, relative water content and SPAD value under salinity in a dose-dependent manner, which were observed for assessing the growth and physiological responses. However, proline content and oxidative stress indicators such as MDA content and H₂O₂ content were increased with the increase of salinity. Consequently, it caused a reduction in pod length, pod plant⁻¹, seed pod⁻¹, seed yield plant⁻¹, stover yield and biological yield. In responses to, 300 and 450 mM NaCl-induced salt stress, plant death occurred after completing the vegetative stage. Phenotypical and anatomical parameters showed a visible deleterious effect of different levels of salinity on growth and number of stomata, respectively. On the contrary, exogenous application of Se, B and Se+B reverted the negative effect of salinity. Though, the combined application of Se+B showed a slight difference in result than Se or B alone, the findings indicate that exogenous application of Se, B and Se+B mitigated the adverse effects of salinity by up regulating physiological and biochemical processes and by enhancing growth parameters.

Keywords: abiotic stress, plant nutrition, ion homeostasis, oil crops, oxidative stress, trace elements

FUTURE FARMING ENABLING SDG AND AGRO 4.0 IR

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Abstract

Although the safe food demand is continuously growing. By 2050 we will need to grow 70 percent more food. The reality is that very little innovation has taken place in the industry of late – in any case. Four main developments are placing pressure on the legacy agriculture model in meeting the demands of the future: demographics, scarcity of natural resources, climate changes, and food waste are all intensifying the hunger and food scarcity. Agriculture 4.0 will never depend on applying water, fertilizers and pesticides uniformly across entire field. Instead, farmers will use minimum quantities required and target very specific areas. Future agriculture will use different sensors, devices, machines, aerial images, GPS, precision agro, robotics tech, and IT that will be more efficient profitable, safe and environment friendly. Considering these few experiments were conducted at Indoor grow-house of FAB LAB in Sher-e-Bangla Agricultural University to evaluate the development of microgreens produces and evaluation of growth and nutritional profile under different LEDs light combination. The experiment comprised of two factors, viz., Factor Four different crops (C1: Mustard, C2: Lettuce, C3: Broccoli, C4: Radish) and five different levels of LEDs light (White L1: 100; Red L2: 100; Blue L3: 100; Red: Blue L4: 70:30; Red: Green: Blue L5: 70:10:20). Among the different crops, the highest yield got in (108.67gm) was found from C1 and the lowest (78.27gm) from C3. Considering the LEDs light treatment, L2 produced the highest yield (125.67) and the lowest (76gm) was from L1 and L4. Regarding the interaction effect, the highest yield of treatment (251gm) was obtained from treatment combination L2C1 and the lowest (64gm) from L4C1. According to single treatments and treatment combinations C1, L2 and L4C1 performed significantly better in terms of hypocotyl length, chlorophyll fresh and dry weight of individual plants. L4C1 performed better than others for marketable qualities and safety parameter. The highest (1701BDT) and lowest (1344BDT) gross income was obtained from L4C1 and L1C1 treatment combination, respectively. So, combination of red and blue light (70:30) can be economically used for mustard micro-green production. Again, Yield performance of lettuce and pak-choi in hydroponic under rooftop and indoor conditions. Yield contributing parameters and yield of pakchoi at harvest influenced by different LED-light spectral ratios. We also conducted few more IoT based device and developed solar powered agri-machineries combating carbon emissions etc. Agriculture 4.0 is disrupting the system is doable with new technologies.

Keywords: 4 Agro-IR. LED treatment. Indoor farming. Safe vegetables production

STOCK ASSESSMENT OF COMMERCIALLY IMPORTANT FISHES IN THE BAY OF BENGAL THROUGH MOLECULAR MARKERS: MANAGEMENT POLICY IMPLICATIONS

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Abstract

Stock (population) identification is very crucial both in the context of monitoring and conservation of the fish species of marine and open water habitats. The present research was conducted accordingly in the BoB aiming to determine and categorize the population of some commercially important marine fish species. In this study, about one hundred samples of each species of ten marine fishes namely, *Pampus chinensis*, *Pampus argenteus*, *Euthynnus affinis*, *Auxis thazard*, *Megalaspis cordyla*, *Lates calcarifer*, *Setipinna tenuifilis*, *Sillaginopsis panijus*, *Polyneemus paradiseus* and *Coilia dussumieri* were collected between October 2020 and April 2022 mainly from coast and rivers of two ecological regions of Bangladesh coast: the South - west (Borguna-Khulna-Patuakhali, KP) coastal zone and the South - east (Chattogram-Cox's Bazar, CC) coastal zone based on different physico-chemical characteristics of habitat (KP: high brackish water area with dense clayed particle in river and estuaries; CC: sandy area with more clear saline water river and estuaries) and biology of species (e.g. migratory, amphidromous, anadromous etc.). For amphidromous or anadromous fish, samples were collected from coastal rivers. Fish/tissue samples or DNA sequence data of other seas in the Indian Ocean region (e.g. Southern BoB, Andaman Sea, Arabian Sea, Persian Gulf etc.) and South-west Pacific (e.g. South China Sea, Gulf of Thailand etc.) were collected from different researchers and scientific studies. For genetic diversity and stock study, sequence variations in different mitochondrial DNA gene regions such as COI, Cytb, and noncoding control region (d-loop) were examined Polymerase Chain Reaction (PCR) was used to amplify the target mtDNA region and sequenced by sequence analyzer. Lastly, the variation in the obtained DNA sequence data of different geographic locations were analyzed using different bioinformatic softwares such as Geneous, ARLEQUIN, MEGA-6; TCS etc. For all the genes in every sampling locations of Bangladesh, the nucleotide diversities (π) were very low (0.0001 ~ 0.05) but the haplotype or gene diversities (h) were relatively high, 0.5 ~ 1.0 (i.e. $h > 0.5$) indicates that the studied fishes have experience population expansion after a period of low effective population size, except two species, *M. cordyla* and *L. calcarifer* for which the gene diversities were also low (0.14 ~ 0.263). This result

implies that these two fish species of Bangladesh have experienced recent bottleneck. Immediate conservation measures should be immediately taken for these two species, such as limiting catch, banning on fishing season, making long term sanctuary or protected area etc. Neutrality tests such as Tajima's D and Fu's F_S statistics also suggested that most of the studied fish species of Bangladesh populations have undergone the demographic history of population expansion. Interestingly, the population statistic F_{ST} , and exact test of population differentiation revealed two different scenarios for two group of fishes. The first group contains six fish species namely *P. chinensis*, *P. argenteus*, *E. affinis*, *A. thazard*, *M. cordyla*, *L. calcarifer*. Fishes of this group have similar characteristics. These fishes are mostly oceandromous, pelagic and highly migratory. They are widely distributed throughout the Indian Ocean and South-West Pacific (or, Indo-west Pacific). These fish showed no significant population genetic structuring indicating that these six species have single genetic stock and these are panmictic (random mating among populations) throughout Bangladeshi marine water. Bangladesh should manage these species as a single conservation unit. Further, these six migratory fish showed its own genetic structure ($F_{ST} P \leq 0.05$) within the BoB when compared with other neighboring seas such as Arabian Sea, Andaman Sea, Gulf of Thailand, South China Sea etc. So, the BoB countries should manage and conserve these vital and shared marine species through cooperation with each other. On the other hand, the second group consists of four species *S. tenuifilis*, *S. panijus*, *P. paradiseus* and *C. dussumieri* is relatively distributed to the narrow or localized geographic area mostly in the BoB and Andaman Sea. These fishes are mostly off-shore or coast dwelling and amphidromous (i.e. migrate between fresh and marine water but not to breeding purpose). For these species, pairwise F_{ST} values of mtDNA markers among fish samples of different sampling rivers showed significant differences ($P \leq 0.05$) in most of the cases. Different rivers showed their own genetic stock for different fish such as Bishkhali, Kirtankhola and Boleshwar river for *P. paradeseus* and *S. panijus*; Naf and Pashur river for *C. dussumieri*; Matamuhuri and Bishkhali river for *S. tenuifilis* etc. Based on this result, it is recommended that different river populations of studied fish having unique genetic structures (i.e. genetic stock) require separate monitoring and management strategies for conservation because the population of each river is genetically distinct and overfishing in any of the rivers may cause extinction of its fish stock. So, it is needed to maintain good water flow and direction such as by regular dredging and also needed to control water pollution for the good ecosystem to safeguard these fish species.

Keywords: BoB, population, stock status, molecular marker, fisheries management

ASSESSMENT OF PLASTIC AND OTHER ANTHROPOGENIC DEBRIS POLLUTION IN BEACH AND MARINE HABITATS WITH ITS PREVALENCE IN FISHES OF SAINT MARTIN'S ISLAND

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Abstract

Plastics and other anthropogenic debris have become emerging global pollutants due to their widespread dispersion and potential threats to marine ecosystems. In the present study, we have evaluated two types of pollution in Saint Martin's Island (SMI). First, we assessed the abundance and distribution of different anthropogenic debris (i.e. marine debris) comprising large/macro plastic (MaP; Size: ≥ 5 mm) items (e.g., plastic bottle, snacks and polythene packet etc.) and other debris materials (e.g., paper, cloth, wood, metal etc.) on the beach and underwater habitat. Secondly, microplastic (MP) concentration was assessed in the beach sand, marine waters, and three coral-associated fish species of SMI with their chemical composition (polymer types). Both field study and laboratory analysis were performed in the present study.

After first arrival of the research team at SMI for the present study, a beach cleaning activity was performed by the research team and volunteers from where available marine debris (MDB) of SMI was collected and counted. A total of 2549 items of MDB were counted for a combined weight of 62.35 kg from 10 collection sites during the beach cleaning event which contained a total of nineteen types of MDB, namely plastic bottles, snacks packets, soft plastic, coconut shell, straw, hard plastic, transparent polythene, tin can, paper, cloth, net, rope, wood, cork sheet, glass, rubber, metal, foam and mask.

In the assessment of daily accumulation of debris particularly by tourists along with other people, a total of 10153 numbers of MDB (i.e., MaP and other debris items) for a combined weight of 212.81 KG belonging to 20 types were measured in this study. The densities of MDB ranged from an average of 0.077-0.446 items per square meter of beachfront. Soft plastic was found to have the highest (25.91%) followed by snacks packet (20.77%) and plastic bottles (16.07%), coconut shells (8.66%), paper (5.89%), transparent polythene (4.83%), straw (3.85%). The other categories of debris like paper, cloth, net, rope, wood, cork sheet, nylon sacks, glass, rubber, metal, foam, mask were found as the lowest (less than 3%). Daily accumulation rates for marine debris were the highest on Saturday (18.05%) followed by Friday (16.95%) and Sunday (14.98%) which

denotes more MDB abundance is high in the national holidays when the tourist number is usually high.

The MP concentration in sediment samples of SMI was 51.67 to 278.33 particles per kg sand which were counted as 1225.65 to 6213.02 particles/m² area. The highest concentration of MPs was found in Site-5 (Navy point) whereas the lowest concentration was found in Site-1 (Chera dip). On the other hand, we measured the average MPs pollution in the marine water samples of SMI as 0.03 particles/m³ of water which varied from 0.014 to 0.059 particles/m³. The highest concentration of MPs was found in Site-3 (adjacent marine water of Jetty) whereas the lowest concentration was found in Site-1 (marine water near Chera Dip). In the study of microplastics accumulation in fish, the average size of MPs found in orange-spotted grouper (*Epinephelus coioides*) was 24-1000 micrometers. The average size of MPs in two spotted red snapper (*Lutjanus bohar*) and black pomfret (*Parastromateus niger*) were 540-940 and 150-200 micrometers, respectively.

A total of five types of polymers in microplastics namely, Polyethylene (PE), Polypropylene (PP), Polystyrene (PS), high-density low-density Polyethylene (HDPE), low-density Polyethylene (LDPE) polymers were identified in sand and water samples. Polyethylene (PE) was found the most dominant (32%) followed by HDPE (24%), PP (20%) and LDPE (16%). PS was found the lowest as 8%.

A total of 116 items of thirteen types of marine debris (MDB) were found in underwater habitats and the average marine litter and debris pollution in underwater habitats varied from 0.12 to 1.18 items/meter. The highest number of MDB were found Near Jetty Ghat (52%) followed by in front of the coast guard office (25%). The lowest MDB was found in Jetty of Chera dip (5%).

The possible sources of macroplastic and microplastic in SMI were tourist plastic waste, nearby market waste, domestic plastic waste, and fish-market plastic waste. This work provides detailed plastic (macro and micro) pollutants and other anthropogenic debris data in the beach and water environment of SMI for the first time. It would be helpful for making effective strategies to deal with environmental problems of this recently declared MPA.

Two attractive giant sculptures of a coral fish and a sea turtles were set up at the beach made by using discarded plastic and polythene wastes collected from the beach. These unique art pieces were made to encourage the tourists and policy makers reducing, refusing, reusing and recycling of plastic pollutants in SMI. A number of waste bins were also distributed to the shopkeepers of beach shops so that they accumulate and remove the plastic debris and wastes in a certain place, not on the beach.

Keywords: Saint Martin's island, micro plastic, marine debris

DIVERSITY AND DNA BARCODING OF CORAL-ASSOCIATED FISHES OF SAINT MARTIN'S ISLAND FOR EFFECTIVE CONSERVATION OF MARINE LIFE.

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Abstract

Saint Marin's Island (SMI), is the only sedimentary continental island in Bangladesh. We have conducted an ichthyological survey to assess the reef-associated fish species on this island. In this survey, we have identified and recorded 141 species of reef-associated fishes of 56 Families under 20 Orders. Among them, 37 species of reef fishes were recorded for the first time in Bangladesh and one is discovered as a new species to the science during the current study. In this study, we also obtained 221 DNA sequences from 100 species of which 179 sequences (96 species) were obtained from the COI gene and 42 sequences (26 species) obtained from the 16S rRNA gene region. The COI sequences of those 96 species comprised 145 haplotypes with 337 polymorphic sites. The mean genetic distances within species, genera, and families were 0.34%, 12.26%, and 19.03%, respectively. In the case of 16S rRNA sequences, 42 sequences of 26 fish species comprised 31 haplotypes containing 241 polymorphic sites. The mean genetic divergence within species, genera and families was 0.94%, 4.72% and 12.43%, respectively. This study is a significant contribution to the fisheries statistics of this ecologically critical area (ECA) and Marine Protected Area (MPA) of Bangladesh as well as the northern Bay of Bengal which would facilitate the assessment of species catch composition and hence for strategizing management plans. It is also an important input to the DNA barcode library of reef fishes of the northern Bay of Bengal and to the marine fishes of Bangladesh as well as global DNA barcode entries in general.

Keywords: ichthyological survey, Saint Martin's island, mitochondrial DNA

ASSESSMENT OF UNDERWATER BIODIVERSITY OF SAINT MARTIN'S ISLAND OF BANGLADESH

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Abstract

Occupying less than one percent of the ocean floor, reefs are home to more than twenty-five percent of marine life. Saint Martin's Island (SMI) is the only island in Bangladesh where a reef-like ecosystem is found. An underwater survey was conducted to uncover the underwater biodiversity on this island in the winter seasons from 2016 to 2019. The photographs of these species were captured by scuba diving and snorkeling in a water depth of about 3 to 7 meters. The study revealed 131 faunal and 18 floral species of different taxa viz. Bivalves (5 species), Crabs (5 spp.), Feather star (1 sp.), Fireworm (1 sp.), Fishes (53 spp.), Flatworm (1 sp.), Hard corals (27 spp.), Hermit crab (1 sp.), Jellyfishes (3 spp.), Lobster (1 sp.), Octopus (1 sp.), Sea anemones (3 spp.), Sea cucumber (1 sp.), Sea fans (8 spp.), Sea fern (1 sp.), Sea slug (6 spp.), Sea turtle (1 sp.), Sea snail (1 sp.), Sea star (1 sp.), Sea urchin (1 sp.), Sea whip (1 sp.), Sponges (3 spp.), Tubeworms (4 spp.), Zoanthid coral (2 spp.), and Seaweed (18 spp.). Coral bleaching was also observed in this study. The present study exposes the hidden beauties of rich underwater biodiversity of this island to the people with the hope to take part in supporting and conserving this island by the tourists, related stakeholders and government.

Keywords: Saint Martin' Island, underwater survey, snorkeling, scuba diving, coral.

DEVELOPMENT OF FISH FLESH POWDER AND POWDER-BASED COOKIES AND SNACKS FROM PANGUS, SILVER CARP, TILAPIA AND TUNA FISH (PATENT NO: IPC: A 23L 17/00, 1006455, 19/2020)

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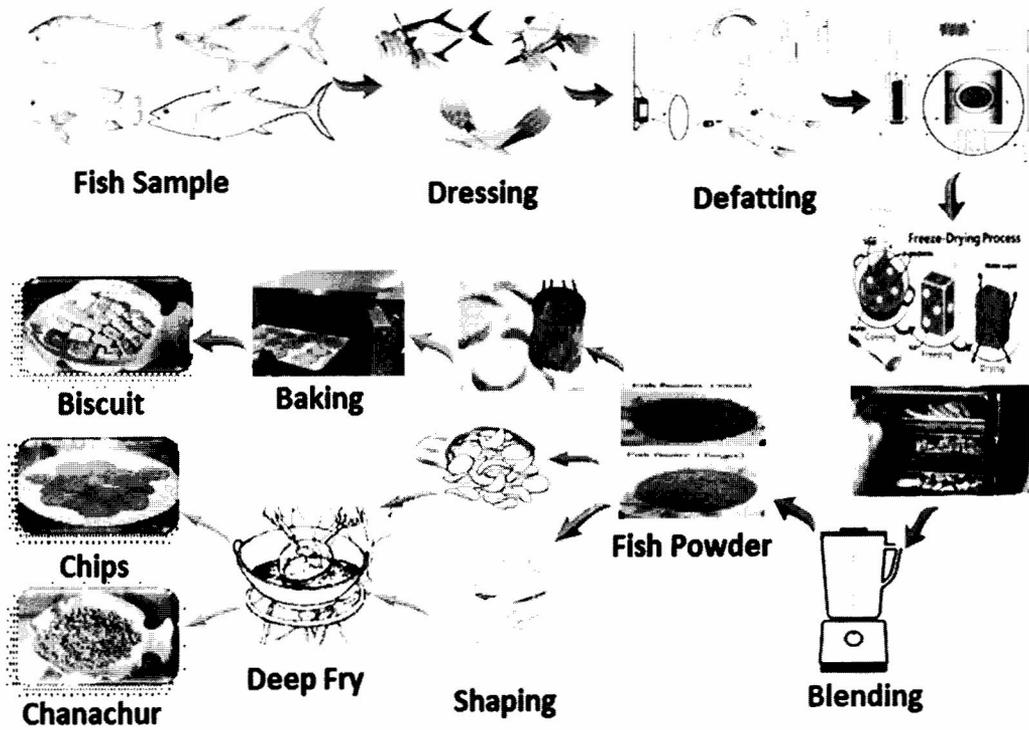
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Abstract

Generally, the cookies and snacks available in the market are made of flour, leavener, salt, sugar, butter, egg, oil and some other extra added flavor in some special case. White, processed flour and more starch in the regular diet increase blood sugar, which in turn puts unnecessary stress on the liver. Fish consumption helps to reduce coronary heart disease incidence and mortality due to having beneficial effects omega-3 PUFA, EPA & DHA. Increased protein intake also balances blood sugar and insulin, reducing cravings and detoxing the liver. Therefore, fish protein-based food is relatively nutritious and safer than carbohydrates for human body. A method was developed for producing powder from fish having protein content ranged between 80-90% (dry basis). Then, the value-added fish cookies and snacks (viz. biscuit, chanachur & chips) were made from fish powder containing 30-40% protein. Major portion of fats were removed from fish flesh which protects the products from fat oxidation. Bacterial population of the developed products were found ranged between 1.3×10^3 to 2.4×10^3 CFU/gm. The present invention reveals that if we can add the fish protein to produce the cookies and snacks like biscuits, chanachur and chips it would be safer for health with helping in balancing blood sugar and detoxing the liver.

Keywords: fish flesh powder, cookies, nutritious, low-cost, value addition

Graphical Abstract:



DEVELOPMENT OF LOCALLY ENGINEERED LOW-COST RECIRCULATING AQUACULTURE SYSTEM (RAS) IN BANGLADESH

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Abstract

The Recirculating Aquaculture System (RAS) is a healthy method of producing fish in which fish are continuously grown in the same water at high densities in regulated environments. The method guarantees every environmental factor that attests to a fish-friendly atmosphere and a high level of culture system, which would create a new export market for various local species. Bangladesh hence has a significant demand for aquaculture mechanization and intensification through RAS. The RAS system must be affordable, easy to use, and efficient. The usage of regional resources in a certain fish culture, the surrounding environment, and fish pricing must all be taken into account in the design. Testing of local species is therefore necessary for the creation of an effective RAS. One of the most important ways to maximize water reuse and increase fish output in Bangladesh is to establish and test low-cost RAS utilizing local resources. In addition to these, using solar power to reduce energy costs would be a wise move. For this reason, the goal of the current research project is to create a locally manufactured RAS through the fabrication of crucial components for the intensive cultivation of high-value species utilizing resources that are readily available and indigenous technology. For the purpose of cultivating commercial fish species, a project is developed to create, modify, and validate a locally engineered RAS.

To ascertain the current state of RAS in Bangladesh, a KII was carried out with various RAS entrepreneurs, importers, equipment makers, and service providers. Among the various important concerns, some of the more significant ones were improper RAS design, insufficient technical expertise, a shortage of experienced labour, equipment selection, water flow rate computation, species selection, excessive operating costs, etc. In order to lower the RAS's operating costs, an engineering design and technical specifications were created based on the findings. The water recirculation system was designed using an underground gravity flow mechanism. The water recirculation system was designed using an underground gravity flow mechanism. Low-cost tanks with a sloping bottom were designed and built. A total of twelve FRP tanks and twelve triple tanks with PVC supports, each with a capacity of 3.5 cubic meter, were built. To get rid of the majority of the solid particles in the water, a low-cost vortex filter was added to the system. It was noted that the material used in Moveable Bed Reactors (MBBRs) manufactured locally is effective in removing ammonia from water. An oxygen cone constructed locally proved successful in raising the inflow water's oxygen content. When compared to traditional RAS, it was found that locally designed, low-cost RAS is efficient in raising fish using less energy.

Keywords: indoor fish culture, intensive aquaculture, recirculating aquaculture, energy