



Short communication

Variability studies for quality characters in *neikumbalam* accessions

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Abstract

Vaidyakumbalam/medicinal ashgourd or *neikumbalam* is a specific ecotype of ashgourd in Kerala which is highly valued for its medicinal properties. *Neikumbalam* is the principal ingredient used in the preparation of the Ayurvedic medicine “*Kooshmanda rasayanam*” and “*poosanilehyam*”, a similar preparation made by the Siddha medicine physicians. In the present study, *neikumbalam* accessions were collected from different locations in Kerala and laid out in field experiment along with vegetable ash gourd variety “Indu”. Fully mature fruits were harvested and used for phytochemical screening and biochemical estimation. Phytochemical screening of the fruit extracts revealed the presence of sugars, starch, proteins, amino acids, tannins, phenols, glycosides and flavanoids in both type of ash gourds. The biochemical analysis of mature fruits of *neikumbalam* revealed higher content of total minerals and total free amino acids. The *neikumbalam* type BH 4 recorded significantly highest total free amino acid content and total mineral content than other accessions.

Keywords: Antioxidant property, *Benincasa hispida*, Medicinal ashgourd, *Neikumbalam*, Total free amino acids, Total minerals.

Benincasa hispida is a commonly used cucurbitaceous vegetable which has been used as a food and medicine for thousands of years in the Orient (Mathad et al., 2005). Its fruits contain various minerals and vitamins, having a relatively high level of K and Na, low calorific value and no fat. The fruit also contains 11-70 mg of calcium per 100 g and 0.3-0.45 per cent of other minerals (Pandey et al., 2015).

Ash gourd (*Kushmanda*) has been mentioned in ‘Charaka Samhita’ for its medicinal properties. It has been used in India to treat disorders of the gastrointestinal tract, respiratory tract, urinary tract and *diabetes mellitus* (Asolkar et al., 1992; Sivarajan, 1992). According to Sanskrit texts, *Benincasa hispida* fruit is useful in insanity, epilepsy, constipation, piles, dyspepsia, and other nervous disorders. The fruit of *B. hispida* is used

as a diuretic and the seeds have been reported to possess antiangiogenic effects in prostate cells (Nandecha, 2010). Ash gourd, being low in calories, is particularly useful for diabetic and obese people. It is cooling and laxative and thus increases the secretion and discharge of urine. Ash gourd acts as a blood coagulant (Pandey et al., 2015). Fresh juice is given either with sugar or as an adjunct to other medicines for these diseases (Patricha, 1997). A decoction of the fruit is styptic, laxative, diuretic and given to cure internal haemorrhages and diseases of the respiratory tract. For centuries, it has been used in many empirical applications in India for various ailments such as gastro intestinal tract problems like dyspepsia and burning sensation, heart disease, vermifuge, diabetes and urinary disease. The fruit is an important source of water-soluble and hemicellulosic polysaccharides (Mazumder and Lerouge, 2005).

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In silico* analysis of putative transcription factor binding sites in the promoter region of drought responsive bZIP1 gene in rice and its orthologue in *Arabidopsis thaliana

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Abstract

The regulation of various biological processes in the plant systems, especially during different adverse climatic conditions are brought about by the change in the expression of different genes which in turn is the result of the binding of specific transcription factors in their respective transcription factor binding sites (TFBSs). In plants, basic region/leucine zipper motif (bZIP) transcription factors regulate processes including pathogen defense, light and stress signaling, seed maturation and flower development. In this study, an *in-silico* analysis was done to predict the TFBSs for the *bZIP1* gene of rice responses to drought. The AGI code of *bZIP1* was utilized for the prediction of TFBSs by performing orthologue search against *Arabidopsis* genome in RGAP (Rice Genome Annotation Project) database. Further, TFBSs were identified by AthaMap database, a genome-wide map of TFBSs in *Arabidopsis thaliana*, and STIFDB2 (Stress Responsive Transcription Factor Database V2.0) database which is a comprehensive collection of biotic and abiotic stress responsive genes in *Arabidopsis* and *Oryza sativa* L. The significant TFBSs were analyzed based on the parameters provided by databases and were cross validated. The results revealed that the MYB, HSF and WRKY Transcription Factor families and their respective TFBSs were predicted as functionally significant. These predicted TFBSs would be responsible for the change in expression of *bZIP1* gene under water stress. Such information will also help to understand the metabolic, physiological and cellular mechanisms implicated in such processes. These studies could help to engineer the plants for resistance to stress and achieve better yield in crop plants.

Key words: *Arabidopsis thaliana*, AthaMap, bZIP1, Drought, Rice, STIFDB2, TFBSs.

Introduction

Understanding the molecular mechanisms that underlie stress tolerance would be the first step in the generation of stress tolerant crops. Plants are often subjected to unfavorable environmental conditions – abiotic factors, causing abiotic stresses which play a major role in determining productivity of crop yields, and also the differential distribution of the plants species across different types of

environment. A remarkable feature of plant adaptation to abiotic stresses is the activation of multiple responses involving complex gene interactions and crosstalk with many molecular pathways (Nguyen et al., 2016).

Abiotic stresses elicit complex cellular responses that have been elucidated by progress made in exploring and understanding plant abiotic responses at the whole-plant, physiological, biochemical,

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Original Research Article

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Proficiency of Post-harvest Treatments in Maintaining Sensory and Organoleptic Quality Attributes of Rambutan (*Nephelium lappaceum* L.) during Ambient Storage

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ABSTRACT

Keywords

Rambutan, Browning, spinterns, Sulphitation, Scores, Ozonization, Paraffin

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Water loss is the major problem in rambutan which induces the browning of spinterns and ultimately reduces the consumer acceptance. Techniques which slow down respiration and dehydration rate were found to be more effective in increasing overall acceptability of rambutans. The efficacy of several pre-treatments in up regulating consumer acceptance of rambutan (*Nephelium lappaceum* L.) fruit was examined. Dipping fruits for 5 min in 2 ppm ozonized water comparably reduced the browning of the fruit stored under room temperature ($30 \pm 2^\circ\text{C}$; 80-85% RH). On the other hand, waxing treatments did not reduce browning but retained excellent internal fruit quality. Sulphitation (350ppm) solution was not effective in reducing browning and enhancing marketable value. It was concluded that ozonization (2ppm) treatment recorded lowest browning score (4.10) and superior in general appearance (4.83), taste and flavour with minimum pulp browning at the end of shelf life.

Introduction

Rambutan (*Nephelium lappaceum* L.) is an important exotic fruit, indigenous to Southeast Asia, including Thailand, Malaysia, and Indonesia (Lam *et al.*, 1987). It is a good source of vitamin C, calcium and provides fairly a good amount of niacin, iron, phosphorus, carbohydrate, protein, and fibre. As a non-climacteric fruit, rambutan must be harvested at the peak of maturity as further ripening does not continue after harvest

(O'Hare, 1995; Wall *et al.*, 2011). The most attractive and distinctive feature of rambutan fruit is its bright red or yellow peel and spinterns (Landrigan *et al.*, 1996). The flavour of the juicy aril is a blend of sweet and sour taste (Lam *et al.*, 1987). Farmers in many parts of Kottayam and Pathanamthitta in Central Travancore have taken rambutan cultivation to cater the demand of fruits from traders in Tamil Nadu and Karnataka (Kuttoo, 2009). However, the presence of the hair like spinterns makes the fruit very

GROUP DYNAMICS EFFECTIVENESS FOR ENTREPRENEURIAL

BEHAVIOUR: LEARNED EXPERIENCES OF WOMEN

SELF-HELP GROUPS IN AGRICULTURE

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ABSTRACT

One of the most powerful approaches to rural entrepreneurship is the formation of the Self Help Groups (SHGs) especially among women. Collective farming by women SHGs was promoted in Kerala as a strategy to enhance the livelihood options of poor women. Many SHGs have been set up micro enterprises by value addition of agricultural products. A study was undertaken to analyze the group dynamics effectiveness of SHGs in agriculture and its relationship with entrepreneurial behaviour. The study was conducted in six selected SHGs with agriculture and agriprenurship activities. One SHG each was selected from six selected panchayats of six blocks of Thrissur District. The group dynamics of each SHG was quantified by using an index called Group Dynamics Effectiveness Index (GDEI), consisting of 12 dimensions. The Kruskal –Wallis one way analysis showed considerable variation in group dynamics effectiveness among different groups. There were significant differences between different SHGs in case of six indicators viz; commitment, leadership, interpersonal trust, adherence to group norms, empathy and achievement of SHG. Out of six SHGs, two SHGs possessed higher scores for most of the dimensions. The study also revealed that more than 70 per cent of the members possessed medium entrepreneurial index. The relationship between group dynamics effectiveness and entrepreneurial behavior was analyzed. Out of twelve dimensions, possessed highly significant relationship with entrepreneurial behaviour. Leadership and group cohesiveness had highest correlation coefficients compared to other dimensions.

KEYWORDS: Group Dynamics Effectiveness & Entrepreneurial Behaviour

Original Article

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INTRODUCTION

A group is a cluster of two or more individuals who interact with each other on a relatively enduring basis, identify themselves as belonging to distinct unit and sharing certain common activities and values. Self Help Group can be described as a small and economically homogeneous affinity group of rural poor voluntarily formed to save and mutually contribute to a common fund to be lent to its members. Self Help Groups are seen as instruments for a variety of goals, including empowering women, developing leadership abilities and delivering micro-finance services to poor populations that have been otherwise difficult to reach directly through banks or other institutions.



Research Article

STUDY ON POD SET AND POLLEN VIABILITY IN YARD LONG BEAN (*Vigna unguiculata* subsp. *sesquipedalis*)

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Abstract: A study was conducted in a yard long bean (*Vigna unguiculata* subsp. *sesquipedalis*) hybrid VS 50 (Kakkamoola Local) x VS 26 (Vellayani Jyothika) to assess the percentage fruit set at two time intervals and to identify the best time interval for pollination in yard long bean hybrids. Hand pollination was done using VS 50 as female parent and VS 26 as male parent for seven days at two time intervals, 6.30 – 7.30 am and 7.30 – 8.30 am. Higher percentage of fruit set (36.8 %) was observed between 6.30 – 7.30 a.m. as compared to the time interval 7.30 – 8.30 a.m. (23.8%). Pollen viability was determined for the parents VS 50 (Kakkamoola Local) and VS-26 (Vellayani Jyothika) at 6.30, 7.30 and 8.30 am. Highest pollen viability for both the parents VS 50 and VS 26 was observed during 7.30 a.m. The present study shows that the best time interval for crossing in yard long bean is 6.30-7.30 a.m.

Keywords: Yard long bean, *Vigna unguiculata* subsp. *sesquipedalis*, hybridization, pod set, pollen viability

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Introduction

Vigna unguiculata subsp. *sesquipedalis* (L.) Verdcourt commonly known as yard long bean or pole type vegetable cowpea is a commercially used leguminous plant with very long pods and climbing growth habit, widely grown in China, South and South East Asia. It belongs to the family Fabaceae and is one of the most popular and remunerative vegetable crop traditionally grown in Kerala, cultivated mainly for crisp and tender pods that are consumed both fresh and cooked. It is a rich and inexpensive source of vegetable protein and enriches soil fertility by fixing atmospheric nitrogen. It has become an essential component of sustainable agriculture in marginal lands of the tropics because of its quick growth habit. Productivity of the crop is limited by a complexity of biotic (pest and diseases) and abiotic (rainfall, temperature, relative humidity and light intensity) factors. Some attempts have been made to study the genetic and environment variability for various productive traits, inheritance of these traits and correlation between yield and its components. So far no public sector hybrids of yard long bean are available for cultivation in Kerala, which makes farmers to depend on private sector hybrids by paying exorbitant prices. There is an urgent need to improve the crop for better yield and quality through heterosis breeding. Cultivar improvement in self-pollinated species is done by hybridization. Because of poor crossing success and less number of seeds per pod, heterosis is difficult. Pod yield and yield attributes in vegetable cowpea are complex traits governed by polygenic inheritance, affected by environment. Both genotype and environment affect the crossing success in self-pollinated species such as vegetable cowpea. Cowpea is highly self-pollinated, the result of a cleistogamous flower structure and simultaneous pollen shed and stigma receptivity [1], although some crossing may occur due to insects. Self-pollinated nature is due to hermaphrodite sex form, homogamy and dehiscence of anther much earlier than anthesis. Stamens and pistil in opened flower remain enveloped together inside the tube like structure of joined petals called as Keel, leading to cleistogamous nature. Flowers open only once between 7.00 and 9.00 a.m. On cloudy days the flowers may open even in the afternoon. Anther dehiscence is influenced by environmental factors such as clear sky, presence of moonlight, warm temperature etc. and it may vary from 10.00 p.m. at night to 1.00 a.m.

Stigma become receptive and pollen become fertile on the day of anthesis. Several hybridization procedures have been developed [2,3]. High hybrid pod set is observed when emasculation is done before anthesis which is followed by pollination on the day of anthesis in morning hours. [2] reported that some cowpea genotypes are superior pollinators as compared to others which are seed parents. Time and efforts in crossing play an important role in expressing efficient parental donors for crossing. The cross VS 50 x VS 26, identified as a superior hybrid for yield and quality, was used for the present study. The aim of the study was to observe the percentage fruit set at two time intervals in the yard long bean hybrid VS 50 x VS 26 and the influence of pollen viability of the parents at different times on fruit set, in order to identify the best time interval for pollination in yard long bean hybrids. Resmi and Gopalakrishnan, (2004) [4] reported problems such as delayed and erratic flowering and low pod set in yard long bean.

Materials and Methods

The study was conducted at the Department of Vegetable Science, College of Agriculture, Vellayani during February to March 2017. Lakshmi, (2016) [5] conducted a diallel analysis to study the heterosis and combining ability of yard long bean (*Vigna unguiculata* subsp. *sesquipedalis* (L.) Verdcourt) and to develop superior hybrids with high yield and quality. Based on the mean performance, specific combining ability and standard heterosis, the hybrid VS 50 x VS 26 (Kakkamoola Local x Vellayani Jyothika) was observed to be one of the most promising for yield and quality characters. With this background, the cross VS 50 x VS 26 (Kakkamoola Local x Vellayani Jyothika) was selected for the study. The source and characters of the parents VS 50 and VS 26 are given in [Table-1].

Table-1 Source and characters of parents used for the study

Parent	Name of Accession	Source	Character
VS 50	Kakkamoola Local	Kakkamoola, Thiruvananthapuram, Kerala	High yield, long pods
VS 26	Vellayani Jyothika	College of Agriculture, Vellayani, Kerala	High yield, long pods



Research Article

PHENOTYPING OF VASCULAR STREAK DIEBACK DISEASE (VSD) RESISTANT COCOA HYBRIDS AND ENDORSEMENT OF RESISTANT GENE IN AUSPICIOUS GENOTYPE BY EMPLOYING MOLECULAR MARKER SYSTEMS

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Abstract- Cocoa (*Theobroma cacao* L.) is native to humid tropical region of Central America and considered as important agro forestry tree species. Vascular streak dieback (VSD), a devastating disease with distinct symptoms of dieback, is one of the major threats for cocoa cultivation. The confounding part of this disease is that chemicals have little effect on disease control. The most tenable and economic technique to tackle this disease is by evolving resistant materials. When this disease began to assume unmanageable magnitudes in India, Kerala Agricultural University had initiated VSD resistant breeding since 1995. Initially, 566 hybrids which expressed tolerance in the nursery for two years were field established. After fifteen years of field screening, 46 hybrids which manifested field resistance were selected for further study. Examination on self-incompatibility position exhibited that majority of them (37) were self incompatible. When yield contributing characters were accessed VSD I 31.8 was found to be superior and out rated the checks, most popular varieties available. Disease resistance was further confirmed by budding and molecular markers. VSD I 31.8 (CCRP 15) can be consider as a novel hybrid released in the world with VSD resistance and considerable yield.

Keywords- *Ceratobasidium theobromae*, resistance breeding, *Theobroma cacao* L., VSD, hybrid.

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Introduction

Cocoa (*Theobroma cacao* L.) is native to humid tropical region of Central America and considered as important agro forestry tree species [1,2]. Vascular streak dieback (VSD), a devastating disease with distinct symptoms of dieback, is one of the major threats for cocoa cultivation. The disease was first delineated in Papua New Guinea, engendered by the fungus *Oncobasidium theobromae* [3]. Contemporary studies led to reclassification of the causal organism to another basidiomycete fungus, *Ceratobasidium theobromae* [4]. In India, the disease was first promulgated by Abraham, (1981) [5] and then by Chandramohan and Kaveriappa, (1982) [6]. The confounding part of this disease is that chemicals have little effect on disease control [7-10] and the only control method recommended is frequent pruning of infected branches below the visible symptoms [8,11,12]. However, incessant pruning will result in inhibition of cocoa growth and moreover it is labour - intensive and exorbitant [13].

The most tenable and economic technique to tackle this disease is by evolving resistant materials [14-16]. When this disease began to assume unmanageable magnitudes in India, Kerala Agricultural University had initiated VSD resistant breeding since 1995 [17,18] and this paper reveals the variability prevailing among identified resistant hybrids and endeavour to tag VSD resistant gene in most auspicious genotype of this breeding programme.

Materials and Methods

The hybridization programme to address VSD was initiated in KAU during 1995-

96, deploying thirty-one females and four male parents [19]. Since the causal organism is obligate parasite, artificial inoculation of pathogen was not possible. Hence, inoculum was dispensed by keeping already infected seedlings around the experimental materials [20]. After nursery screening for two years, 566 seedlings which manifested resistance were planted in a separate block as VSD set I [16]. These plants were perpetuated under uniform level of management and scored for disease incidence as per the score developed by Abraham, et al., (2000) [8] [Table-1] for fifteen years during the peak period of infestation.

Table-1 Score chart for vascular streak dieback infestation in cocoa

Disease scale	Intensity of Infection
0	No infection
1	< 25 per cent of twig infected
3	25-50 percent infection
5	50- 75 percent infection
7	> 75 per cent infection
9	Mortality of the plant

Fifty hybrids were deduced with score 0 indicating no infestation during the entire period of investigation [19]. At present only forty-six hybrids are retained in the field and four were defunct due to natural calamities and details are given in [Table-2]. Incompatibility positions of these hybrids were figured out by selfing 100 flowers per tree, as per the procedure advised by Mallika, et al., (2002) [21].

Short Communication

Biological efficiency of chilli + amaranth intercropping system under fertigation

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Abstract

An experiment was conducted at Water Management Research Unit, Vellanikara during January to July 2017 to study the biological efficiency of chilli+ amaranth intercropping system under different nutrient and water regimes. The treatments consisted of chilli + amaranth intercropping system planted at two different planting geometries viz., normal row planting and paired row planting, three nutrient levels viz., 100, 75 and 50 per cent NPK recommendation of both crops as fertigation and two irrigation levels viz., 100 per cent Epan and 75 per cent Epan along with two controls viz., chilli pure crop and amaranth pure crop. Biological efficiency of intercropping system was assessed by calculating LER, LEC, ATER, RCC and CEY. Chilli + amaranth intercropping under normal row planting produced significantly higher LER (2.84) compared to paired row planting. The intercropping system fertilized at 100 per cent of the recommended NPK dose to both crops showed the highest LER (2.81) compared to lower doses. Irrigation at 100 per cent Epan recorded significantly higher values of LEC (1.54) and ATER (2.56). Chilli equivalent yield was higher in chilli+ amaranth intercropping system (16553 kg/ha) compared to pure crop. The higher values of LER (>1.0), LEC (> 0.25), ATER and CEY revealed the biological efficiency of chilli + amaranth intercropping system compared to pure crop system.

Keywords: ATER, CEY, Intercropping, LEC, LER, RCC.

India ranks second in vegetable production, next only to China, and contributes about 12 percent of the world's production. The estimated production of vegetables in Kerala is 8.25 lakh MT as against the requirement of 36.7 lakh MT with practically little scope for horizontal expansion of the area under cultivation. Hence technology needs to be generated to include vegetables in the intercropping systems. Intercropping will help to increase total production per unit land per unit time. Productivity of intercropping systems can be enhanced by curtailing inter and intra species competition for various resources. This is possible by selecting compatible crops, adopting suitable planting geometry and proper water and nutrient practices. Fertigation is widely popularized as an efficient and economically viable method for water and nutrient

management, on account of its highly localized application and flexibility in scheduling water and fertilizer applications. Research works on optimal schedules for micro-irrigation, fertigation and planting geometry in intercropping systems are very limited. The present study was done against this back drop and to assess the biological efficiency of chilli + amaranth intercropping system under different nutrient and water regimes.

The experiment was conducted at Water Management Research Unit, Vellanikara from January to July 2017 in randomized block design with three replications. Chilli variety (Ujwala) with longer duration (150 days) and wider spacing was taken as the base crop, and amaranth (Arun) with shorter duration (75 days) and closely spaced was

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Research Article

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Constraints Faced by Agripreneurs in Adopting KAU (Kerala Agricultural University) Technology

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ABSTRACT

A study was conducted with the objective of studying the constraints faced by agripreneurs in adopting KAU (Kerala Agricultural University) technology. A sample of 100 respondents who had adopted KAU technology were selected using simple random sampling technique. The study revealed that lack of adequate money for day-to-day expenses was the most important financial constraint faced by the agripreneurs, followed by lack of market information. Non-availability of input materials and high labour cost were the major production and labour constraints and multiple roles was the major personal constraint faced by the agripreneurs.

Keywords : Agripreneurs; Constraints; Kerala Agricultural University; Technology

INTRODUCTION

A shift from farming to agribusiness is an important pathway to rejuvenate Indian agriculture and to make more appealing and profitable venture. Agripreneurship have the potential to add to a scope of social and economic advancement, for example, income generation, employment creation, poverty reduction and development in health, nutrition and overall food security in the national economy.

Agripreneurship is defined as "generally, sustainable, community-oriented, directly-marketed agriculture. Sustainable agriculture denotes a holistic, system oriented approach to farming that focuses on the interrelationships of social, economic, and environmental processes" (Nagalakshmi and

Sudhakar, 2013). Agricultural businesses are always coupled with inherent ambiguity associated with agricultural production. Some significant sources of uncertainty in agribusiness include production risk, price risk, financial risk and changes in government programmes.

In India, 52% of the total land is cultivable as against 11% in the world (Uplaonkar and Biradar, 2015). Large population of India is dependent on agriculture for their source of revenue. But Indian agriculture is low in productivity with large number of disguised unemployment. But it is clear that there is a great scope for entrepreneurship in agriculture and this potential can be tapped only by effective

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Original Research Article

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Evaluation of the Efficacy of New Generation Granular Insecticides against Rice Yellow Stem Borer, *Scirpophaga incertulas* (Walker) in Thiruvananthapuram District, Kerala, India

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ABSTRACT

Keywords

Chlorantraniliprole 0.4 G, Cartap hydrochloride 4G, Fipronil 0.3G, Yellow stem borer, *Scirpophaga incertulas*

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A field experiment was carried out at Integrated Farming Systems Research Station, Karamana, on rice variety Uma (MO 16) during Kharif 2017, to study the impact of new generation granular insecticides on rice yellow stem borer, *Scirpophaga incertulas* (Walker). Results showed that in terms of efficacy against stem borer, on the basis of overall performance of granular insecticides, fipronil 0.3G at 10 and 20 kg ha⁻¹ was found to be more effective and superior among other granules in reduction of stem borer infestation to minimum of 1.84 and 2.13 per cent of dead hearts (DH) and 5.63 and 4.07 per cent of white ear heads (WEH) respectively. This was followed by Cartap hydrochloride 4G at 25 and 50 kg ha⁻¹ with 4.61 and 4.63 per cent of DH; 7.00 and 6.40 per cent of WEH respectively. The untreated control recorded 9.61 per cent of DH and 12.41 per cent of WEH respectively. Chlorantraniliprole 0.4 G at 10 kg ha⁻¹ found to be the least effective one with 5.46 and 9.23 per cent of DH and WEH respectively.

Introduction

Rice (*Oryza sativa* L.), the most vital cereal crop of India, is grown in an area of 43.39 million hectares with a production of 104.32 million tons in the year 2015-16 (D and ES, 2017). To deal with eternally exigent insect pest tribulations in rice, IPM practices like integration of varietal technology, cultural methods, biological control and utilization of insecticides is the most important and effective tool available to the rice farmer. The farmer has to adopt these latest technological

interventions in pest management. The yellow stem borer is the most serious pests of rice in all parts of India, South and South East Asia, Japan and Korea and causes heavy yield losses. Pesticides are most commonly used to manage rice pests. Misra and Parida (2004) found the positive impact of insecticidal use in the production of rice. Production is linearly interrelated with insecticide use in rice. Khan *et al.*, (2010) claimed that insecticide application in paddy increased the yield of Basmathi-385 by 42.6 to 54.5 per cent compared to control and attained the cost



Management of water cabbage [*Limnocharis flava* (L.) Buchenau] using new generation herbicides

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ABSTRACT

A field experiment was conducted during *rabi* season of 2011-2012 at College of Agriculture, Vellayani, Kerala, India to evaluate three promising new generation herbicides for managing water cabbage. The experiment was laid out in randomized block design with eight treatments replicated thrice. The treatments comprised of Azimsulfuron @ 20 and 30 g/ha, bispyribac-sodium @ 20 and 30 g/ha, (metsulfuron-methyl + chlorimuron-ethyl) @ 4 and 6 g/ha, 2,4-D @ 1 kg/ha and a weedy check. The results of the field study on weed control efficiency of the different herbicides indicated that 2,4-D @ 1 kg a.i. ha⁻¹ was most effective for controlling water cabbage. Among the new generation herbicides (metsulfuron methyl + chlorimuron ethyl) @ 6 g a.i. ha⁻¹ and bispyribac sodium @ 30 g a.i. ha⁻¹ were equally effective for controlling water cabbage. Azimsulfuron at both doses were found to be least effective in controlling water cabbage.

Key words: New generation herbicides, Phytotoxicity, Weed control efficiency.

INTRODUCTION

Water cabbage [*Limnocharis flava* (L.) Buchenau], an aquatic invasive alien weed was introduced as an ornamental plant in India. It has invaded vast tracts of low lying wetland system in Kerala and has become a serious threat to paddy cultivation. The options for managing water cabbage at present include ploughing down, manual uprooting, and the use of selective herbicides like 2,4-D. With the explosive increase in labour cost and difficulty in labour availability, rice farmers have started replacing manual weeding with herbicides. However, Nakyama *et al.* (1999) reported that *Limnocharis flava* in Malaysian agricultural rice fields was not killed by the application of 2,4-D as it became resistant due to continuous use in Malaysia. Despite the obvious advantages of herbicides, their use has also raised concerns relating to human health and the environment. Therefore, to identify and screen new herbicides that are economically viable and ecologically safe has become the need of the hour. The new generation of herbicides are much more environment friendly, controlling weeds with grams of active ingredients per hectare as opposed to kilograms per hectare required for the older herbicides like 2,4-D. Low use rates of these new generation herbicides allow farmers to achieve higher yields while applying 95 - 99 per cent less herbicides to their crops (Kathiresan, 2001). With this background, the present study was undertaken to identify promising new generation herbicides for managing water cabbage.

MATERIALS AND METHODS

A field experiment was conducted during *rabi* season of 2011-2012 at College of Agriculture, Vellayani,

Kerala, India to evaluate three promising new generation herbicides for managing water cabbage. The site chosen for the experiment was thickly infested with water cabbage and was left fallow. The soil of the experimental field was sandy clay loam in texture having pH 6.2, organic carbon 1.14% and available N, P and K 310.50, 26.40 and 183.10 kg ha⁻¹ respectively. Rice fallow thickly infested with water cabbage was ploughed down, puddled as in the case of wetland rice and a wait period was given for uniform regrowth. The experiment was laid out in randomized block design with eight treatments replicated thrice. The treatments comprised of Azimsulfuron @ 20 and 30 g/ha, bispyribac-sodium @ 20 and 30 g/ha, (metsulfuron-methyl + chlorimuron-ethyl) @ 4 and 6 g/ha, 2,4-D @ 1 kg/ha and a weedy check. The herbicide spray solution in water was prepared as per the treatments and was sprayed uniformly over the weed foliage when maximum number of water cabbage plants was at 2 to 3 leaf stage. Care was taken to ensure uniformity in spraying and to avoid drift.

Azimsulfuron was applied to field retaining 8 cm of standing water and the water level was maintained for five to seven days after herbicide application. Bispyribac-sodium was applied to field having 2-3 cm of standing water and the water level was maintained thereafter. The water was drained out from the field before application of metsulfuron-methyl + chlorimuron-ethyl and was reflooded 3 days after herbicide application and maintained a standing water of 3-4 cm. The field was drained before 2,4-D application and was reflooded 48 hours after herbicide application and thereafter water level was maintained at 3-4 cm.

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Genome-Wide Association Study and Pathway-Level Analysis of Kernel Color in Maize

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ABSTRACT Rapid development and adoption of biofortified, provitamin A-dense orange maize (*Zea mays* L.) varieties could be facilitated by a greater understanding of the natural variation underlying kernel color, including as it relates to carotenoid biosynthesis and retention in maize grain. Greater abundance of carotenoids in maize kernels is generally accompanied by deeper orange color, useful for distinguishing provitamin A-dense varieties to consumers. While kernel color can be scored and selected with high-throughput, low-cost phenotypic methods within breeding selection programs, it remains to be well established as to what would be the logical genetic loci to target for selection for kernel color. We conducted a genome-wide association study of maize kernel color, as determined by colorimetry, in 1,651 yellow and orange inbreds from the Ames maize inbred panel. Associations were found with *y1*, encoding the first committed step in carotenoid biosynthesis, and with *dxs2*, which encodes the enzyme responsible for the first committed step in the biosynthesis of the isoprenoid precursors of carotenoids. These genes logically could contribute to overall carotenoid abundance and thus kernel color. The *lcyE* and *zep1* genes, which can affect carotenoid composition, were also found to be associated with colorimeter values. A pathway-level analysis, focused on genes with *a priori* evidence of involvement in carotenoid biosynthesis and retention, revealed associations for *dxs3* and *dmes1*, involved in isoprenoid biosynthesis; *ps1* and *vp5*, within the core carotenoid pathway; and *vp14*, involved in cleavage of carotenoids. Collectively, these identified genes appear relevant to the accumulation of kernel color.

KEYWORDS
colorimeter
carotenoid
isoprenoid
genome-wide
association
study
biofortification

Malnutrition, or hidden hunger, remains a serious issue, even as increased agricultural productivity has helped to provide more energy and calories on a global scale (Welch and Graham 1999). As much as half of the world's population may be deficient in one or more micronutrients, with 125–130 million pre-school children and 7 million pregnant women suffering from vitamin A deficiency (VAD) (Stevens *et al.* 2015). Biofortification, the improvement of crop nutritional quality through breeding and/or agronomics, has been proposed as a sustainable tool to help with addressing micronutrient malnutrition (Bouis and Welch 2010), and has been found to be cost-effective (Meenakshi *et al.* 2012; Bouis and Hunt 1999; Qaim *et al.* 2007). Improvement of provitamin A carotenoid levels is generally a promising target, given that naturally occurring yellow and orange-pigmented accessions have been identified for many commonly white-pigmented, starchy staple foods such as maize, cassava, banana, and sweet potato (Amorim *et al.* 2009; Carvalho *et al.* 2016; Takahata *et al.* 1993).

For biofortification to be effective, micronutrient densities must reach levels that impact human health, and the varieties and final food products must be acceptable to growers and consumers. Through decades of technical and broader contextual work, the international breeding organizations of CIMMYT, IITA and HarvestPlus, and partners have achieved the successful development of provitamin A-dense maize varieties, nearing target nutrient levels, which also have local and regional adaptation and relevance (Pixley *et al.* 2013; Menkir *et al.* 2017). Specifically, there has been a need to develop maize with distinctly orange kernel color for enhanced product recognition and enhanced consumer acceptance, including in certain sub-Saharan African nations where white maize is preferred but outreach and educational initiatives have successfully linked enhanced nutritional properties to the novel orange color (Meenakshi *et al.* 2012; Muzhingi *et al.* 2008; reviewed in Simpungwe *et al.* 2017). For the consistent and facilitated development of biofortified, provitamin A-dense maize varieties that meet target nutrient levels and also have strongly orange endosperm, it

Research Note

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Comparative Analysis of Scale of Social capital formed in Kollam and Palakkad districts of Kerala as an Impact of a Pilot Extension Project (LEADS)

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ABSTRACT

Lead Farmer Centered Extension Advisory and Delivery Services (LEADS) is a pilot extension project revolving around lead farmer – satellite farmer concept on an Agro Ecological Zone basis within in a district. Presently LEADS Project is being implemented in four districts of Kerala, namely Kollam, Palakkad, Kannur and Wayanad. The present study was conducted in the Kollam and Palakkad districts of Kerala. The study aimed to compare Social capital formed in Kollam and Palakkad districts as an impact of LEADS project. From the study conducted, it was clear that the social capital formed was found to be more in Kollam than in Palakkad district.

Keywords: LEADS; Lead Farmer; Satellite farmer; Social capital; Kerala

Agriculture Technology Management Agency (ATMA) is responsible for coordination and management of agricultural extension related work in the district level (Nair, 2013). But it has major shortfalls like poor farmer-to-farmer extension and lack of periodic field visit. This thought has led to the design and implementation of a pilot project by the Kerala State Planning board. Lead Farmer Centred Extension Advisory and Delivery Services (LEAD) was proposed for implementation in the state during 2010-11. LEADS Project was found to be successful enough in creating the social capital among the farmers (Sreedaya, 2016).

Social capital is an instantiated informal norm that promotes co-operation between

individuals (Francis, 2010). It is defined as trust, norms or networks existing in the social organization which by its coordinated actions, helps in improving the efficiency of the society (Putnam, 1993). The study aimed to compare the scale of social capital formed among the farmers of Kollam and Palakkad districts through the LEADS project.

METHODOLOGY

The study was conducted in five developmental blocks of Kollam and 5 blocks of Palakkad districts of Kerala with 90 respondents. Comparison of impact created by LEADS in Kollam and Palakkad districts in terms of scale of social capital formed was done by using SOCAT (Social Capital

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Development of CGMS system in ridge gourd [*Luffa acutangula* (Roxb.) L.] for production of F₁ hybrids

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Abstract Cytoplasmic male sterile system in ridge gourd has been converted to cytoplasmic genetic male sterile (CGMS) system through the development of analogues of male sterile (MS) line, maintainer line and fertility restorer line. These lines were developed by crossing the MS mutant, regenerated through in vitro culture, with monoecious pollen parents Deepthi, Haritham, LA 101, CO 2, IC 92761 and IC 92685. All hybrids and the BC₁ generation developed by crossing with the recurring pollen parents Deepthi, Haritham and LA 101 were male sterile. Male sterile BC₁ plants have been advanced to BC₆ generation and the parental line LA 101 was proved to be a successful maintainer line, producing male sterile progeny in successive back cross generations. Analogue of cytoplasmic male sterile line, MS LA 101, was developed through back crossing and on crossing with fertility restorer lines Arka Sumeet and LA 102, this line

excelled as female parent, resulting heterotic combinations. Mitochondrial marker rpS14 and SCAR Tm-53 were identified to yield male sterility specific markers whereas SSR marker 18956 has generated the male fertility specific marker. These primers are recommended for marker assisted selection of ridge gourd, for utilizing male sterility for hybrid seed production and for developing A, B and C lines in CGMS system.

Keywords CMS · Cucurbit · Hybrid seed · Male sterility · Marker assisted selection · SCAR

Introduction

Ridge gourd [*Luffa acutangula* (Roxb.) L.] is a prominent cucurbitaceous vegetable consumed for its immature fruit which is rich in dietary fibre and minerals (Sheshadri 1990). During the period of domestication, diverse sex forms viz, monoecious, androecious, gynoeceous, gynomonoecious, andromonoecious and hermaphrodite were emerged in ridge gourd (Choudhary and Thakur 1965). Male sterility reported in ridge gourd from India (Pradeepkumar et al. 2007) was cytoplasmic in nature, with two dominant male fertility restorer nuclear genes *Rf1* and *Rf2* with complementary gene action governing the restoration of male fertility (Pradeepkumar et al. 2012). Commercial F₁ hybrid seed production in


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Articles

Identifying the markers and tagging a leucine-rich repeat receptor-like kinase gene for resistance to anthracnose disease in vegetable cowpea [*Vigna unguiculata* (L.) Walp.]

Dolagobinda Pradhan, Deepu Mathew , Sally K. Mathew & P. A. Nazeem

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ORIGINAL ARTICLE

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Comparative assessment of growth performance of three different indigenous goat breeds exposed to summer heat stress

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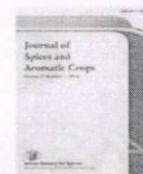
Indian Council of Agricultural Research

Summary

A study was conducted to assess comparatively the growth performance of three different indigenous goat breeds during exposure to summer heat stress. The primary objective of the study was to observe the heat stress impact on the growth performance based on the body weight changes, allometric measurements, growth hormone (GH) concentration and peripheral blood mononuclear cell (PBMC) Insulin-like growth factor-1 (IGF-1) mRNA expression pattern during the summer season in comparison with the local breed (Osmanabadi). Thirty-six ten-month- to one-year-old female goats of Osmanabadi, Malabari and Salem Black breeds were randomly divided into six groups, OC ($n = 6$; Osmanabadi control), OHS ($n = 6$; Osmanabadi heat stress), MC ($n = 6$; Malabari control), MHS ($n = 6$; Malabari heat stress), SBC ($n = 6$; Salem Black control) and SBHS ($n = 6$; Salem Black heat stress). Body weight was recorded at weekly intervals, whereas other growth and allometric measurements and blood collection were carried out at fortnightly intervals. Breed factor significantly ($p < .05$) influenced only few growth variables such as body weight, body mass index (BMI) and body condition score (BCS). However, heat stress treatment significantly ($p < .05$) reduced all growth parameters except BMI. Further, the heat stress significantly ($p < .01$) increased plasma GH concentration in goats with significantly higher ($p < .05$) concentration recorded in OHS. Among the stress groups, the lower ($p < .05$) PBMC IGF-1 mRNA expression was recorded in OHS, while the higher ($p < .05$) expression was observed in SBHS indicating the extreme adaptive capability of Salem Black breed. Thus, the results indicated that the Salem Black breed performed much better compared to both Osmanabadi and Malabari breeds indicating the superior ability of this breed to adapt to heat stress challenges. The results also indicated that plasma GH and IGF-1 gene may act as ideal biomarkers for assessing the heat stress impact on growth performance in indigenous goats.

KEYWORDS

allometric variables, growth, growth hormone, heat stress, IGF-1, indigenous goat



Performance, diversity analysis and character association of black pepper (*Piper nigrum* L.) accessions in the high altitude of Idukki district, Kerala

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Abstract

The experiment was conducted to evaluate black pepper accessions for growth parameters, yield attributing characters and yield. Out of the ten accessions tested, *Karimunda* recorded the highest fresh (1.61 kg) and dry (508.7 g) yield of berries plant⁻¹. Fresh weight showed significant positive genotypic correlation to dry weight and while negative correlated to 100 berry volume, 100 berry weight and number of berries spike⁻¹. Hence, selection based on number of berries spike⁻¹, 100 berry volume and 100 berry weight may not lead to the high yielding black pepper variety. The results showed that *Karimunda* is the most suitable black pepper variety for high altitude areas of Idukki district.

Keywords: black pepper, field evaluation, variability, yield

Introduction

Black pepper, *Piper nigrum* L., referred as the 'King of spices' is the most important spice in the world. Indian pepper fetches a premium price in major international markets due to its preference and intrinsic quality (Thomas 2010). In India, Kerala is famous for black pepper cultivation and export. Idukki and Wayanad are the major pepper growing districts which together contribute 90% of the Kerala production. There exists considerable variation for yield among black pepper cultivars (Ravindran & Babu 1994). Idukki has maximum genetic diversity of black pepper. Most of the pepper farmers in the Idukki district are cultivating a minimum of five cultivars.

Every traditional pepper-growing tract has its own popular cultivar. Selection of cultivars for prevailing agroclimatic conditions is important for higher productivity. The diverse climatic and soil conditions in a state like Kerala necessitates the identification and popularization of location specific varieties for the enhancement of productivity of pepper (Prasannakumari *et al.* 2001). The performance of black pepper varieties varies significantly in plains and high ranges owing to the difference in environmental conditions of these two regions. For evolving high yielding varieties of any crop, knowledge on the relationship between yield and yield attributing characters as well as vegetative characters is essential. Therefore, the present study was initiated with the objective of



Abiotic stress tolerant *Trichoderma harzianum* strain for growth promotion and foot rot management in black pepper

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Abstract

A study was conducted to evaluate and identify an abiotic stress tolerant PGPR and *Trichoderma* sp. for growth promotion and foot rot management in black pepper (*Piper nigrum* L.). The study found *Trichoderma harzianum* (CKT isolate) as the most abiotic stress tolerant isolate for growth promotion and *Phytophthora* management in black pepper nursery maintained under polyhouse conditions (elevated temperature up to 41 °C). In the case of ambient condition (up to 29.7 °C), *Pseudomonas fluorescens* (PAP isolate) was the most promising isolate. However, considering both natural and polyhouse conditions and per cent disease incidence, *T. harzianum* (CKT isolate) was the most promising high temperature tolerant culture for growth promotion and disease management in black pepper nursery.

Keywords: Abiotic stress, black pepper, PGPR, *Phytophthora*, *Trichoderma harzianum*

Introduction

Black pepper is an important spice crop of Kerala and the state is known as “land of spices” due to contribution to Indian economy through export. In India, black pepper production was high in Karnataka (31000 t) followed by Kerala (20000 t) and Tamil Nadu (2000 t) during 2016-17 (Spices Board, 2017) whereas, the area under black pepper was highest in Kerala (85000 ha). The productivity of the black pepper in India declined due to various reasons including biotic and abiotic stresses. Anandaraj *et al.* (2014) reported that black pepper production was highly affected due to spatial and temporal variation in rainfall and temperature. Incidence of *Phytophthora* foot rot in the nursery is a problem in most of the black pepper growing areas of Kerala and cause severe economic loss to farmers (Sarma, 2003). The chemical control measures are harmful to the beneficial microorganisms and hazardous to the environment. An alternate method should be developed to mitigate the biotic and abiotic stresses,

which is effective, low-cost and eco-friendly. In this context, plant growth promoting microorganism (PGPM) could be a potential tool for growth promotion, disease management and abiotic stress tolerance in black pepper. PGPM are associated with plant roots and mitigate the impact of abiotic stresses effectively (drought, low temperature, salinity, metal toxicity and high temperature) (Potters *et al.*, 2007) and biotic stresses (pest and diseases) (Lugtenberg and Kamilova, 2009).

Beneficial effect of *Azospirillum* inoculation has been reported in black pepper (Kandiannan *et al.*, 2000). Raza and Faisal (2013) reported that *Micrococcus luteus* (chp37) produced cytokinin which improved the plant growth directly in maize plants. Castanheira *et al.* (2016) reported that most of the *Burkholderia* strains were able to solubilize mineral phosphate, synthesize IAA, produce siderophore and antagonistic to plant pathogenic oomycetes. Deshwal, *et al.* (2013) reported *Pseudomonas* sp. as an effective plant growth

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