



30th International Horticultural Congress

12 - 16 August 2018 • Istanbul - Turkey

IHC2018-Symposium 35

VIII International Symposium on Seed, Transplant and Stand Establishment of Horticultural Crops

ORAL PRESENTATIONS

SESSION I: Seed Quality and Health

KEYNOTE 1

SEED QUALITY IS CRUCIAL TO SUCCESSFUL SEEDLING PRODUCTION IN HORTICULTURE

Alison Powell*

Institute of Biological and Environmental Sciences, University of Aberdeen, Cruickshank Building, Aberdeen, AB24 3UU, UK

[*a.a.powell@abdn.ac.uk](mailto:a.a.powell@abdn.ac.uk)

Reliable and uniform establishment in the field and glasshouse is essential in horticultural production both in conventional production of uniform seedlings and plants, and in the production of the rootstock and scion for grafted seedlings. Seed quality, specifically germination and vigour, plays a major role in achieving these aims. Commercial seeds are sold with a standard germination (SG) that is specified to be above a required minimum standard, but seed lots with acceptable levels of SG can show differences in vigour leading to differences in the rate and uniformity of establishment and final emergence. High vigour seed lots emerge rapidly, uniformly and well under a wide range of conditions, compared to the slow, asynchronous and often poor emergence of low vigour lots. High vigour seed lots also show greater longevity during storage. Seed aging is the main cause of vigour differences and has formed the basis for the development of vigour tests that identify high and low vigour seed lots. These tests enable seed companies to plan their marketing and storage strategies and can be used to provide guidance to growers. Five vigour tests developed within the International Seed Testing Association have been validated for a number of species, with further work on validation in progress. A recently developed test, applicable to a wide range of species, assesses early counts of radicle emergence and can be automated. Research shows that the tests apply to a wide range of species, including legumes, Brassicas and cucurbits, as well as onion, pepper, aubergine and flower species. The physiological basis and development of these tests, and their use in identifying characteristics of seed lots that are important to horticulture will be discussed. Differences in seed vigour and the results of vigour tests will be explained in terms of an aging / repair hypothesis.

Keywords: seed vigour, seed aging, validated vigour tests, aging / repair hypothesis





30th International Horticultural Congress

12 - 16 August 2018 • Istanbul - Turkey

OS 1-1:

SEED HEALTH AND QUALITY OF SELECTED VEGETABLE CVS. FROM DIFFERENT SEED PRODUCERS

Retha Slabbert*, Riana Kleynhans

Department of Horticulture, Tshwane University of Technology, Pretoria, South Africa

*slabbertmm@tut.ac.za

There is an increased interest and need to produce vegetables by home gardeners and small-scale farmers, and this trend can play an important role to enhance food supply and reduce the risk of hunger, poverty and malnutrition. Seed quality is one of the main factors that affect crop production potential. Differences in seed quality leads to various problems experienced in home garden and small-scale vegetable production including low seed germination, variation in seed counts per packet, and high seed cost. The objective of this study was to investigate the differences in seed quality of selected vegetable cultivars from different seed producers available from a commercial retail outlet, for home gardening and small-scale farming. The experiment was carried out under a controlled environment in a laboratory, and the germination, seed health, number of seeds per packet, seed weight and seed price were compared. There were significant differences in the seed quality parameters measured, concerning seed germination, seed weight and number of seed per packet and the possible effect on vegetable production and cost for home gardeners and small scale farmers, is discussed.

Keywords: home gardeners, seed germination, seed weight, vegetables





OS 1-2:

IMPLEMENTING CLIMATE-SMART DRY CHAIN TECHNOLOGY TO MAINTAIN THE QUALITY OF OKRA SEEDS

Irfan Afzal*, Muhammad Bakhtavar, Shahzad Basra

University of Agriculture, 38040 Faisalabad, Pakistan

*irfanuaf@gmail.com

High seed quality is a prerequisite for seedling establishment and efficient crop production, yield, and thereby farmers income. Even when seeds are harvested with high quality, there can be losses in horticultural seeds. The primary cause of such losses is poor storage due to high seed moisture contents at harvest and damp storage conditions, which can be minimized through management of seed moisture content by implementing Climate-Smart Dry Chain technology. The Dry Chain involves drying of the product (whether through natural or artificial means) as soon as possible after harvest followed by hermetic packaging to maintain dryness until used in the value chain. Maintaining low seed moisture content is the most important factor for preserving high seed viability and vigor during storage. In the present study, okra cv. Sabz Pari seeds were dried to 8, 10, 12 and 14% seed moisture content (SMC) using zeolite drying beads and were stored in hermetically sealed bag and traditional bags (paper bag, polypropylene bag, jute bag and cloth bag) for 6, 12 and 18 months. Increased SMC followed by poor germination (50%) was noticed in traditional bags while germination and vigor were maximal (95 %) in hermetic bags due to maintenance of low SMC. Overall, hermetic bags are effective in maintenance of seed quality by preventing moisture and air entry into the stored seeds thus preserved the dryness of okra seed in storage. While seed storage in hermetic bags at higher SMC (14%) led to loss of viability at a faster rate, even compared to traditional porous bags, it suggests a more important role of seed moisture in deteriorative process compared to oxygen.

Keywords: seed, germination, moisture content, hermetic storage, quality





30th International Horticultural Congress

12 - 16 August 2018 • Istanbul - Turkey

OS 1-3:

SINGLE RADICLE EMERGENCE COUNT FOR PREDICTING VIGOUR OF MARIGOLD (*Tagetes erecta* L) SEED

Hülya İlbi^{1*}, Ozlem Alan²

¹Ege University, Faculty of Agriculture, Dept. Of Horticulture, 35100 Bornova Izmir, Turkey

²Ege University, Odemis Vocational School, 35760 Izmir, Turkey

*hulya.ilbi@ege.edu.tr

Many seed vigour tests have been developed for many horticultural species, but not for ornamental seeds. Therefore, this study was carried out to determine whether a single radicle emergence count (RE) can be used for vigour assessment as a predictor of seedling emergence in marigold (*Tagetes erecta* L) seed lots. The 6 commercial seed lots were used for standard germination test, radicle emergence test and field emergence test. Single radicle emergence counts (2 mm) were performed at 25, 42, 49, 66, 73, 90, 97, 114, 121, 138, 145, 162 and 169 hours of germination (20°C, dark/30°C, light conditions, between papers). The seeds of each lot were sown in May for field emergence test and the percentage of seedling emergence was calculated after 25 days. Although the seed lots had germination percentage of 78% at least, their field emergence varied from 34% to 88,75%. The seedling emergence in field conditions highly correlated with radicle emergence count at 66 hours of germination ($r = 0.9102$, $P < 0.001$) but not with germination percentage. Regression (R^2) values between field emergence and radicle emergence count at 66h was 0,83. The results indicated that single count of radicle emergence at 66h can be proposed as a routine vigour test and indicative of relative field emergence for marigold seed.

Keywords: vigour test, radicle emergence test, *Tagetes erecta*, marigold seed, field emergence test





OS 1-4:

GOOD SEED AND PLANT PRACTICES – AN EXAMPLE OF A PROCESS APPROACH TO PREVENTING CMM FROM ENTERING THE TOMATO PROPAGATION CHAIN

Claire Peusens^{1*}, Emmanuel Lesprit²

¹Good Seed and Plant Practices (GSPP), Vossenburchkade 68, 2805 PC Gouda, The Netherlands.

²Union Française des Semenciers, 17 rue du Louvre, 75001 Paris, France

*c.peusens@gspp.eu

Good Seed and Plant Practices (GSPP) is a private scheme whose objective is to prevent the occurrence of *Clavibacter michiganensis* subsp. *michiganensis* (Cmm) in the tomato production chain. Severe outbreaks of Cmm led to the establishment of the GSPP Foundation by the French and Dutch seed and plant trade associations in 2009.

The GSPP Standard and the trademark are owned by the Dutch-French foundation, GSPP. In the context of GSPP, participants share experiences, expertise and knowledge in order to develop and improve the outbreak prevention system. The general principles are laid down in the GSPP Standard. The requirements of this standard include the quality management system, a risk assessment of defined threats (water, people, propagation material, materials/equipment) in production processes and its control measures and the technical requirements.

Accredited companies that fulfil all the requirements ensure the availability of healthy seeds and plants. They are allowed to produce and to market seeds and plants under the GSPP trademark. GSPP participants are seed companies, seed producers, seed technology companies and plant raisers, that all operate in the business chain of producing tomato seeds and young plants. They are audited periodically by one of the two auditing organizations. Their independent verification confirms that GSPP participants are compliant with the GSPP Standard. As of February 2018, 40 companies apply the GSPP Standard and 95 production sites have been accredited in 18 countries worldwide.

As a joint responsibility of all partners in the business chain, GSPP is a successful approach to preventing Cmm from entering the tomato production. The paper describes this sophisticated pest risk management system, the requirements of the system and the way in which it is organized. The underlying principles and practices of GSPP –pest risk management, tracking and tracing and extensive global cooperation and exchange of information and expertise between companies– could be more widely applicable, beyond their current scope, to other diseases or crops.

Keywords: *Clavibacter michiganensis* subsp. *michiganensis* (Cmm), quality management, risk management, process approach, systems approach, hygiene management





SESSION II: Transplant Quality and Stand Establishment

OS 2-1:

COMBINING LED LIGHTING AND SEED PRIMING TO ENHANCE DROUGHT RESISTANCE AND NUTRITIONAL CONTENT OF ROCKET (*Eruca sativa*)

Daniel Ginzburg, Joshua D. Klein *

ARO-Volcani Center, Institute of Plant Science, Rishon LeZion, Israel

*vcjosh@agri.gov.il

Both LED lighting and seed priming with plant growth regulators or essential oils induce drought tolerance in seedlings by enhancing phytopigment concentration and antioxidant activity, and maintaining leaf water status. Because of the similar stress-tolerance responses induced by LED lighting and seed priming, we investigated interactions between the two treatments in inducing drought tolerance in rocket (*Eruca sativa*). Drought tolerance was quantified both morphologically and physiologically. Seeds were treated with either the brassinosteroid homobrassinolide (HBR), prohydrojasmon (a synthetic jasmonate), or the essential oil carvacrol. Growth under both blue and red LEDs (separately and together) enhanced pigment concentration, antioxidant activity before and during drought, and fresh weight and dry weight% after recovery from drought. Compared to well-watered plants under white light, 50R:50B increased chlorophyll content by 50%. Carotenoids and antioxidant activity increased by 54% and 48%, respectively under 25R:75B. All combined R:B light treatments increased leaf thickness by 35-40% before drought and increased leaf specific weight by 14-24% after 4d of drought compared to white light. After recovery from drought, plants that had been under 25R:75B increased in fresh weight by 32% while dry weight% increased 30% and 17% under 100B and 100R, respectively, compared to plants that had been under white light. Additive interactions between light and priming treatment were observed in antioxidant activity and flavonoid concentration during drought. Compared to water controls, HBR treatment increased antioxidant activity by 50% under 50R:50B. During drought, flavonoid concentration was increased by 23% in plants from carvacrol-primed seeds under 75R:25B, and by 16% in plants from prohydrojasmon-primed seeds under 100B. The upregulated metabolites from both lighting and seed priming treatments are nutritionally valuable; therefore adopting an effective priming-and-lighting protocol could result in improved water use efficiency and crop quality.

Keywords: carvacrol, jasmonate, brassinosteroid, pigments, antioxidants, LEA protein, ABA synthesis





OS 2-2:

***Piriformospora indica* INCREASED PAKCHOI BIOMASS THROUGH SHIFTS IN RHIZOBACTERIA COMMUNITY STRUCTURE UNDER SOIL CULTIVATION**

***Danfeng Huang**, Jianli Liao, Yun Liang, Muhammad Khalid

800 Dongchuan Road, Shanghai Jiaotong University, 1-211, Building of Agriculture Biology, Shanghai, 200240, China

*hdf@sjtu.edu.cn

Piriformospora indica (Pi) is a beneficial endophytic fungus of a wide host range with diverse functions for improving plant growth. The rhizosphere is the most important interface between plant and soil, playing key roles in nutrient processing, mediation of plant growth and disease resistance. However, the interaction between Pi and rhizobacteria is rarely understood. Here, we applied pyrosequencing with 16S rRNA gene to investigate the differences in rhizobacteria of pakchoi (*Brassica campestris* ssp. *chinensis* L.) after Pi inoculation. A clay loam soil was collected from an organic farm (30°51'N, 121°5'E) and used for pot trial under greenhouse conditions. The soil was inoculated with 1% (w/w) Pi by sandwich layer model. The pakchoi plants were harvested 45 days after transplanting and growth parameters were measured. The rhizosphere soils were sampled, and microbial DNA extracted for the subsequent sequence on an Illumina miseq sequencer. The fresh weight of pakchoi increased 92.2% in Pi treatment compared to control, indicating the promotion of plant growth by Pi inoculation. Pi inoculation changed the rhizobacterial community composition dramatically (PERMANOVA tests, $P=0.025$), but the rhizobacterial abundance and diversity remained the same. Furthermore, linear discriminate analysis effect size (LEfSe) analysis showed that some bacterial genera were differentially enriched in Pi treatment, including Actinobacteria (Sporichthya, Asccharomonospora, Promicromonospora, Mycobacterium, Microbacterium, Lentzea, Kibdelosporangium, Geodermatophilus, Amycolatopsis, and Aeromicrobium), Bacteroidetes (Niabella, Flavobacterium, and Adhaeribacter) and Proteobacteria (Methylothera and Luteimonas). Except for Geodermatophilus, Aeromicrobium, Niabella, Adhaeribacter and Methylothera, others have been reported as plant growth promoting rhizobacteria (PGPR), which were associated with the ability of phytohormone production, increasing nutrient bioavailability and/or pathogen inhibition. These beneficial rhizobacteria may contribute to plant growth as well. Taken together, our results suggested that the promotion of pakchoi growth may not only be by Pi inoculation but also by the shifts of rhizobacteria composition to PGPR in the rhizosphere.

Keywords: *Piriformospora indica*, pyrosequencing, rhizobacteria, community structure, leafy vegetable





OS 2-3:

IMPROVEMENT OF SALINITY TOLERANCE IN LETTUCE (*Lactuca sativa* L.) SEEDLINGS BY GAMA AMINO BUTYRIC ACID (GABA)

Maryam Seifi Kalhor¹, Elahe Javadi², **Sasan Aliniaiefard^{3*}**, Mehdi Seif², Françoise Bernard¹

¹Shahid Beheshti University, Tehran, Iran

²University of Tehran, Tehran, Iran

³Department of Horticulture, College of Aburaihan, University of Tehran, Imam Reza Blvd., 3391653755 Pakdasht, Tehran, Iran

*aliniaiefard@ut.ac.ir

Gamma-aminobutyric acid (GABA) is an important component of the free amino acid pool with low concentrations in plant tissues. Previous studies showed that GABA level increases in response to many stimuli, including phytohormones, heat shock and physical stimuli. In the current study, the effects of GABA on seedling performance of lettuce plants were studied under salt stress condition. Lettuce seeds (*Lactuca sativa* cv. *Partavousi*) were treated with three NaCl (0, 40 and 80 mM) and two GABA concentrations (0 and 25 µM) in their rhizosphere media during germination and growth of the plants. Results showed that 80 mM NaCl decreased the rate of germination by 50%, while GABA fully removed the negative effects of 80 mM NaCl on germination rate. Salinity caused sharp increases in electrolyte leakage, but GABA caused a reduction in electrolyte leakage in 40 mM NaCl. Maximum quantum yield of photosystem II (Fv/Fm) was improved significantly when seedlings were exposed to 80 mM salinity. Although the level of proline was increased by NaCl treatments in a concentration dependent manner, GABA caused significant reductions in proline concentrations in NaCl treatments. Concentration of hydrogen peroxide (H₂O₂) was decreased by GABA treatment and this reduction was more observed in 40 mM NaCl salinity. In conclusion, GABA can be used in saline water to prevent the negative effects of salinity on the germination of lettuce plants.

Keywords: lettuce, germination, gaba, salinity, oxidative stress





OS 2-4:

RELATIVE GROWTH RATE AND PEPPER SEEDLING QUALITY GROWN IN CYLINDRICAL PAPER POT

Tae-Cheol Seo*, Se-Woog An, Chun-Woo Nam, Hee Chun

Vegetable Research Divison, National Inst. of Horti. and Herbal Sci., 100 Nongsaengmyeong-ro , Wanju-gun 55365, Korea (Republic of)

*tcseo2@korea.kr

Vegetable seedling production technology using the cylindrical paper pot has been recently adopted in a large Korean nursery since its introduction from Ellegaard company, Denmark in 2014. Seedlings grown in cylindrical paper pots are easy for handling and have a rapid rooting after transplanting, in addition of having decomposing traits. However, there are many questions to be further investigated when using this technology. This study was conducted to evaluate the quality and relative growth rate (RGR) of pepper seedlings grown in cylindrical paper pots. Three pepper cultivars were sowed in cylindrical paper pots (volume 53 mL) having 50 cells of plug tray filled with peat-based bed soil and treated with three different concentrations of a standard base nutrient solution ($EC\ 1.5\pm 1\ dS/m$, $N-P-K-Ca-Mg-S = 8.0-2.4-2.4-4.8-1.6-1.6\ me\cdot L^{-1}$) in Korea applied at the first true leaf, and then twice per week. The study was conducted in a glasshouse with temperature set at 15°C as minimum. Seedling growth traits including plant height, stem diameter, leaf number, leaf width, fresh weight, dry weight were measured at 30, 40, 50, 60 and 70 days. At each sampling age, seedlings were transplanted on 15 cm diameter plastic pots filled with commercial bed soil. These seedlings were then grown for additional 14 days under three different night temperatures at 10°C, 15°C and 25°C. After traits measurements, we calculated compactness and DQI (Dickson quality index) at each seedling age, and RGR for 14 days after planting at each seedling. The results showed that compactness and DQI of pepper seedling increased in proportion to seedling age but RGR of pepper grown for 14days was decreased. These results indicate that best qualities of pepper seedlings could be determined by the relationships between seedling compactness and DQI calculated with growth traits and RGR after transplanting.

Keywords: DQI, compactness, TR ratio, criteria, optimum, transplant





OS 2-5:

CONTROL OF TRANSPLANT HEIGHT IN TOMATO USING PLANT GROWTH REGULATOR PROHEXADIONE CALCIUM

Nusret Ozbay^{1*}, Diyar Abdullah Hassan²

¹Bingöl University, Faculty of Agriculture, Department of Horticulture, Turkey

²Directorate of Agriculture Research, Suleymania, Iraq

*oznusret@yahoo.com

The role of plant growth regulators is become important in modulating physiological responses that will eventually lead to producing high quality seedlings. The objective of the current experiment was to investigate the effects of Prohexadione-Calcium (Pro-Ca) concentrations (0, 25, 50, 75, and 100 mg.L⁻¹) and application methods (foliar spray and soil drench), on growth and quality of tomato (*Lycopersicon esculentum* Mill. cv. BT H2274) transplants. Plant growth measurements of the 5-week-old tomato transplants included transplant height, internode length, stem diameter, number of true leaves, leaf area, root length, shoot fresh and dry weights, root fresh and dry weights, and relative leaf chlorophyll content. Application of Pro-Ca caused an immediate vegetative growth reduction, most dramatically demonstrated by a reduction in transplant height (up to 60%) and internodes length (up to 52%), compared with control treatment. There were significant differences in tomato transplant height in response to application methods and Pro-Ca concentrations. The soil drench application method resulted in shorter tomato transplants up to 27% compared to the foliar spray. These results of the current study indicate that lower Pro-Ca concentrations (25 and 50 mg.L⁻¹) can be used to control excessive elongation growth and to produce short tomato transplants. The higher application rates may provide excessive suppression in growth which may lead to a delay in flowering and harvesting.

Keywords: height control, *lycopersicon esculentum*, prohexadione calcium, internode length





OS 2-6:

EMERGENCE, TRANSPLANT VIGOUR, STAND ESTABLISHMENT AND JUVENILE GROWTH OF SOURSOP (*Annona muricata* L.) SEEDLINGS AS AFFECTED BY SEED WEIGHT AND NURSERY MEDIA

Nneka Okoli*, Julius Obiefuna, Innocent Ibeawuchi, Lilian Emma-Okafor, Rosemond Alagba

Federal University of Technology, Owerri, Imo State, Nigeria

*amdereangel@yahoo.com

Poor seedling emergence and vigour are some of the constraints in soursop production. Soursop seed weights of 0.3 - 0.5g (light weight) and 0.6 - 0.8g (heavy weight) were germinated in five nursery media {topsoil (Ultisol), sawdust (*Triplochiton scleroxylon*), topsoil-poultry manure mixture [50:50], sawdust-poultry manure mixture [50:50] and standard nursery mixture as control [Topsoil (3): Poultry manure (2): river sand (1)]}. The 5 x 2 factorial arrangement was laid out in a Complete Randomized Design and replicated four times. Sawdust-poultry manure mixture and sawdust significantly ($p \leq 0.05$) accelerated early emergence (28.0 and 31.3 days respectively) while topsoil-poultry mixture delayed emergence of seedlings (47.7 days). Heavy seeds emerged earliest (28.0 days) while light seeds emerged late (41.7days). Heavy seeds had significantly ($p \leq 0.05$) high percentage emergence (68%) than light seed (42.7 %). Sawdust favoured higher percentage emergence (76.7%) than standard nursery mixture (60%). However, standard nursery mixture sustained vigorous seedling growth in terms of plant height (32.6 cm) and number of leaves (21.8) at 6 MAS in the nursery. The seedlings raised from heavy and light weight seeds showed 78.3 % and 36.7 % survival, respectively at 6 MAS in the nursery. Seedlings that emerged from heavy seeds showed better growth vigour as compared to light-weight seeds. Soursop percentage (%) stand establishment was not significantly affected by seed weight and nursery media. However, stand vigour measured in term of plant height was significantly affected by seed weight and nursery media. Soursop seedlings raised from heavy seeds in standard nursery mixture produced tall seedlings (81.3 cm) in the field. Therefore, for improved soursop seedling production in the nursery and stand establishment, seeds of 0.6-0.8 g weight should be raised in standard nursery mixture.

Keywords: germination, food reserve, heavy seeds, light seeds





SESSION III: Seed Technology

OS 3-1:

MICROBIAL SEED COATING AS A TOOL FOR ENHANCEMENT OF GROWTH AND STRESS TOLERANCE OF VEGETABLE CROPS

Miroslav Vosatka^{1*}, Inês Rocha², Ying Ma², Eva Baldassarre Svecová¹, Rui Oliveira²

¹Institute of Botany Czech Academy Sciences, Pruhonice, Czech Republic

²Centre for Functional Ecology, University of Coimbra, 3000-456 Coimbra, Portugal

*miroslav.vosatka@ibot.cas.cz

With continuous degradation of microbial life in the arable soils due to several factors such as excessive pesticide application, drought and pollution of irrigation water etc. the inoculation with beneficial microbes becomes an essential part of good horticulture practice. There are numerous groups of beneficial soil microbes they can be reintroduced into degraded soil where the native microbial populations were diminished or eliminated. Although these microbes can provide significant benefits to early plant growth, contribute to the stress tolerance and even enhance the final yield of the inoculated crop, the application is often not feasible due to high cost and extra labor involved in microbe introduction. By contrast to inoculum broadcasting or spraying in the field the only feasible mode of introduction seems to be seed coating - incrustation or pelletization. The demands of inoculum for seed treatment are much lower and therefore cost/benefit balance is in favor to extensive implementation of microbial inoculation. Compilation of the results from 6 years of research both in greenhouse and open field brings the evidence on the high potential of microbial seed coating technique exploitable in practical cultivation of several vegetable crops including legumes, onion, leek, tomatoes or cucumbers. Seed coating has been performed mainly with arbuscular mycorrhizal fungi inoculum produced both *in vitro* and *in vivo*, with selected strains of biocontrol mycoparasitic fungus *Trichoderma* spp. specific blends of plant growth promoting rhizobacteria and mixtures of endophytic fungi. Seed coating with particular microbe combination has a potential to increase consistently early growth of the crop, stress resistance and even protein production of some legumes. Possible ways of large scale implementation of coating techniques should be further exploited and drawbacks of the technology addressed and solved to ensure its wider use in horticulture and agriculture. Research funded by Centre of Competence BIORAF, Technological Agency of the Czech Republic (Grant No. TEO 1200080).

Keywords: seed coating, microbial preparations, mycorrhizal fungi, endophytic fungi, plant growth promoting rhizobacteria, legumes





OS 3-2:

AMELIORATIVE EFFECTS OF SOME PRIMING TREATMENTS ON GERMINATION AND EMERGENCE OF LETTUCE SEEDS UNDER HIGH TEMPERATURE CONDITIONS

Nusret Ozbay^{1*}, Midya Jaza Ms. Muhamed²

¹Bingöl University, Faculty of Agriculture, Department of Horticulture, Turkey

²Directorate of Agriculture Research, Sulaymaniyah, Iraq

*oznusret@yahoo.com

The maximum temperature range for lettuce (*Lactuca sativa* L.) germination is 25° to 30°C. Temperatures above this optimum range inhibit germination of imbibed lettuce seed and causes non-uniform stand establishment. The germination failure of completely imbibed lettuce seed at high temperature is termed 'thermodormancy'. One of the effective methods to overcome this dormancy is seed priming. The effects of incorporating Prohexadione-Calcium (Pro-Ca) into priming solutions on germination and emergence performances of lettuce seeds (cv. Carioca) at 20, 30, and 35 °C were investigated. Priming was accomplished by imbibing lettuce seeds for 20 h at 15 °C in darkness in solutions of KNO₃ or KH₂PO₄, each at -1.50 MPa, containing 0, 50, 100, or 150 mg.L⁻¹ Pro-Ca. In Carioca lettuce seeds, the priming treatments reduced thermodormancy and increased seed germination by up to 90% and emergence by more than 300% in respect to control. The results indicated that inclusion of Pro-Ca into the priming solutions can be used as an effective method to overcome thermodormancy and improve germination and emergence performances of lettuce seeds at high temperatures.

Keywords: lettuce, priming, prohexadione-calcium, thermodormancy





30th International Horticultural Congress

12 - 16 August 2018 • Istanbul - Turkey

OS 3-3:

IMPACT OF SEED PELLETING ON GERMINATION POTENTIAL AND SEEDLING GROWTH OF TOMATO SEEDS

Irfan Afzal*, Talha Javed

University of Agriculture, 38040 Faisalabad, Pakistan

*irfanuaf@gmail.com

Seed pelleting facilitates plantability of small seeds in the field by enhancing water uptake, oxygen permeability, vigour and better protection against diseases (seed and soil associated). Due to high cost of tomato seeds, farmers cannot afford economic loss by placing many seeds per planting hole in the field hence creating competition among tomato plants and ultimately results in reduction in final yield. An experiment was conducted to improve the plantability and emergence potential of direct seeded tomato seeds cv Roma through optimizing different pelleting materials. For this purpose, seeds were pelleted with different combinations of bentonite, biochar, calcium oxide and talcum. The results indicate that pelleting had significantly improved germination potential in terms of final germination (16% over control), germination index and germination energy of tomato seeds. Furthermore, root and shoot lengths along with their fresh and dry weights were also improved in pelleted seeds as compared to non-pelleted seeds. Seed pelleting with bentonite and calcium oxide was the most effective pelleting combination for tomato seeds, which required less time for imbibition. The better performance of pelleted seed was associated with improved activity of hydrolytic enzymes and total soluble sugars.

Keywords: seed pelleting, plantability, stand establishment, tomato





OS 3-4:

REMOVING DORMANCY AND IMPROVING GERMINATION AND EARLY GROWTH OF *NELUMBO NUCIFERA* USING DIFFERENT APPROACHES

Saeideh Rostami*, Shirin Dianati Daylami, Sasan Aliniaiefard

Department of Horticulture, College of Aburaihan, University of Tehran, Tehran, Iran

*srostamy@ut.ac.ir

Water lily (*Nelumbo nucifera*) from the family of Nelumbonaceae is one of the most important aquatic plants that used for food and ornamental purposes. Due to lack of commercial cultivation of this plant, danger of extinction is threatening it. In current study, seed germination and emergence of water lily were investigated using different approaches. In the first experiment, to remove the physical dormancy, germination of seeds were investigated at different stages of ripening (including semi-green, semi-brown, fresh brown and one-year-old brown seeds) together with different types of scarification (including seeds with full coating, exclusion part of the seed coat and exclusion whole of the seed coat). The result showed that one year old brown seeds with exclusion part of the seed coat resulted in a better germination rate and germination percentage. After determining the best way to eliminate the physical dormancy, to determine the effects of light spectrums on germination and emergence, seeds were exposed to different light spectra (12/12 hr Hr light/ dark) including red, blue, red-blue (70:30), white and green for 30 days. During the early 15 days of seedling emergence, the longest petiole length was observed in white light (9.6 cm) and the shortest petiole length was found in red-blue and blue lights (0.56 and 0.79 cm, respectively). At the end of the experiment, longest petiole (32.7 cm) was observed in white light-exposed plants. Plants under red-blue lights had the lowest number of leaves (1.8 leaves) compared to leaf number of other light spectra. In conclusion, combination of different spectra in the form of white light is important for seed germination and emergence of *Nelumbo nucifera*.

Keywords: aquatic plants, *Nelumbo nucifera*, dormancy, water lily, germination





30th International Horticultural Congress

12 - 16 August 2018 • Istanbul - Turkey

OS 3-5:

CHANGES IN MELATONIN CONTENT OF PEPPER SEEDS DURING LONG-TERM STORAGE

Gokcen Yakupoglu¹, Sebnem Koklu², Aygul Karaca², Elif Duver², Asima Klicic², **Ahmet Korkmaz^{2*}**

¹Bozok University, Bogazliyan Vocational School, Yozgat, Turkey

²Kahramanmaraş Sutçu Imam University, Faculty of Agriculture, Dept. of Horticulture, Kahramanmaraş, Turkey

*akorkmaz@ksu.edu.tr

Melatonin, (N-acetyl-5-methoxytryptamine), is present in evolutionary distant organisms like bacteria, algae, invertebrates, vertebrates and plants and it may serve as a photoperiodic and circadian rhythm regulator as well as a universal antioxidant. Even though little is known about changes in seed melatonin content during short-term storage, there is no information available on the involvement of melatonin on seed ageing and seasonal variation of seed melatonin content during long-term storage. The main aim of this research is to identify the changes in melatonin content of pepper seeds (cv. Yalova 341) stored for two years at two temperature regimes and to determine the possible effects of melatonin on seed ageing process. For this purpose, pepper seeds (cv. Yalova 341) were treated with 0 μ M or 250 μ M melatonin for one day after which they were stored for up to two years under room temperature (25 °C) or refrigerator (4 °C). The effects of exogenous application of melatonin on seed ageing and change in melatonin content were assessed periodically with various tests and analyses. The results showed that seed melatonin content varied significantly during storage, reaching its peaks in October and bottoming out in August during the course of experiment. On the other hand, seed MDA and H₂O₂ contents were significantly higher and lower in October and August, respectively, and melatonin pre-treatment slightly improved seed germination performance during the course of experiment. These results clearly indicate that the existing circannual rhythm in melatonin levels lasts longer than a year presumably over the life of the seed albeit in a diminishing fashion.

Keywords: melatonin, seed storage, seasonal change, seed ageing





SESSION IV: Transplant Quality and Stand Establishment

OS 4-1:

EFFECT OF NUTRIENT SOLUTION CONCENTRATIONS ON CUCUMBER TRANSPLANTS VEGETATIVE GROWTH AND EARLY YIELD

Gvozden Dumicic^{1*}, Slavko Perica¹, Katja Zanic¹, Kristina Batelja Lodeta², Smiljana Goreta Ban³

¹Institute for Adriatic Crops and Karst Reclamation, Split, Croatia

²University of Zagreb, Faculty of Agriculture, Svetoimunska 25, 10000 Zagreb, Croatia;

³Institute of Agriculture and Tourism, Karlo Hugues 8, 52440 Porec, Croatia

*gdumicic@krs.hr

Growing conditions during cucumber transplant production can significantly affect plant growth. The aim of this study was to determine the effects of different concentrations of nutrient solution (NS) on vegetative growth of cucumber transplants and early yield. Cucumber transplants (cv. Dinero) were grown in rockwool cubes, fertigated with a NS containing (mg L⁻¹): N 235; P 40; K 295; Mg 35; Ca 165; Fe 1; Mn 0.85; Zn 0.72; Mo 0.12; Cu 0.09 and B 1.55 (electrical conductivity: EC 2 dSm⁻¹). The NS was applied at three EC levels (EC 1, 2, or 3 dSm⁻¹) during the first three weeks of transplant growing. EC of 2 or 3 dSm⁻¹ was achieved by concentrating NS and increasing the EC values for 1 dSm⁻¹ daily, during 2 or 3 day. After transplanting in rockwool slabs, plants were grown in the NS of the same composition and EC at 2.2 dSm⁻¹. The transplants were higher at EC 2 dSm⁻¹ (23.9 cm) and 3 dSm⁻¹ (24.7 cm) than at 1 dSm⁻¹ (21.4 cm). This trend was kept following three weeks after transplanting. Transplants grown at EC 2 dSm⁻¹ and 3 dSm⁻¹ had higher number of leaves than transplants treated with EC 1 dSm⁻¹. The transplants grown at EC 3 dSm⁻¹ had 32% higher dry weight than transplants treated with EC 1 dSm⁻¹. Leaf area and specific leaf area were not affected by NS concentration. The leaf chlorophyll A and carotenoids content was increased with EC increasing from 1 to 2 dSm⁻¹. Regarding early yield, plants treated with EC 3 dSm⁻¹ had a 21% increase yield compared to plants treated with EC 1 dSm⁻¹ at the transplants stage. Overall, the vegetative growth and early yield of cucumber transplants was enhanced when plants were grown with an EC of 3 dSm⁻¹.

Keywords: *Cucumis sativus* L., electrical conductivity, irrigation





OS 4-2:

GROWTH AND YIELD OF SUNFLOWER AS INFLUENCED BY TRANSPLANTING AGE AND SPACING IN IBADAN, SOUTHWEST NIGERIA

Henry A. Akintoye^{1*}, Amudalat Olaniyan², Ajisafe Adebayo³

¹NIHORT, Vegetable and Floriculture, NIHORT PMB 5432, Jericho, Ibadan, Nigeria

²Department of Agronomy, Uni. of Ibadan, Ibadan, Nigeria

³National Horticultural Research Institute, Ibadan, Nigeria

*akintoye2005@yahoo.co.uk

Knowledge of the propagation methods and transplanting time of seedling for field establishment and optimum yield is very important in sunflower production. This study investigated the productivity of sunflower to transplanting age and plant spacing in a two season field experiment. Late and early season experiments were conducted from August to November 2015 and May to August 2016 at the National Horticultural Research Institute, Ibadan and Teaching and Research Farm, University of Ibadan, Nigeria respectively. The experimental design was a split plot with three replicates. Treatments consisted of direct sowing, transplanting at 2, 3, and 4 weeks after sowing (WAS) and three spacings, 25 cm × 75 cm, 50 cm × 75 cm and 75 cm × 75 cm. Methods of propagation was the main plot while spacing was the sub plot. Data assessed included plant height (cm), leaf area (cm²), number of leaves, stem girth (cm), number of days to 50% flowering, number of flower buds, flower bud diameter (cm), number of seeds/plant, 100 seed weight, weight of flower bud and dry weights of shoot and root (g). Data collected were analyzed using analysis of variance and data means were compared using Duncan's multiple range tests at 5% probability level. Results indicated that directly sown plants produced the tallest plants, and highest number of leaves, leaf area and yield as compared to the transplanting at various ages. Spacing the plants at 75 cm × 75 cm improved growth and yield of sunflower. As a result of the high yield derived from direct sowing, it is thereby concluded that direct sowing at the spacing of 75cm×75cm is adequate for sunflower production.

Keywords: propagation methods, age of transplant, yield and sunflower





OS 4-3:

ONION SET CULTIVATION AS A SYSTEM FOR OVERCOMING YIELD REDUCTION BY UNSTABLE CLIMATE IN PLANTING PERIOD

Hajime Araki^{1*}, Limin Huang²

¹Field Science Center for Northern Biosphere, Hokkaido University, Sapporo, Japan

²Graduate School of Environmental Science, Hokkaido University, Sapporo, Japan

*araki@fsc.hokudai.ac.jp

Abnormal weather was actualized by global warming in the world and has affected agro-production. Unstable climate during the planting period affected onion (*Allium cepa* L.) yield in Hokkaido, where the production shares more than 60 % in Japan. Onion seedlings are usually planted from late April to early May and onion bulbs are harvested from late August to middle of September in Hokkaido. Before the planting of seedlings, soil is tilled by vertical harrow and up-cut rotary to crush finely for smooth mechanical planting. The variation in onion yield was recorded in the recent 10 years and the coefficient of the variation showed 21.7 % in Sorachi, one of the production areas in Hokkaido. Continuous rainfall from late April to middle May led to the delay of planting operation because field machinery such as tractor and planter could not be operated in wet soil, causing delay of early growth and yield reduction in 2009, 2011 and 2013. Conversely, seedling growth was suppressed by shortage of rainfall in 2014. Set cultivation, planting system of small bulb instead of seedling, began to be examined for obtaining standard yield even in unstable climate. This study evaluated the effect of soil moisture on onion (cv. Kitamomiji 2000) growth using two types of onion, seedlings and plants emerged from the set. Both onion types were cultivated in Wagner pots with 3 ranges of soil moisture based on pF values, 1.6, 2.0 and 2.4. Onion plants emerged from sets increased number of expanded leaves, leaf length and bulb weight in every pF value as compared to seedlings. However, their leaf growth in dry soil (pF 2.4) was smaller than those in the soil with pF 2.0 and pF 1.6 in set cultivation. Set is an alternative nursery for establishment of early growth in onion.

Keywords: global warming, soil moisture, rainfall, early growth





OS 4-4:

EFFECTS OF PLANT GROWTH-PROMOTING RHIZOBACTERIA AND COMPOST OBTAINED FROM OLIVE OIL PRODUCTION WASTES ON ORGANIC TOMATO SEEDLING PRODUCTION

Yüksel Tüzel¹, Gölgen Bahar OZTEKİN^{1*}, Kamil Ekinci², Nurhan Varol³, Hatice Ozhaktan³, Gülay Besirli⁴

¹Ege University, Faculty of Agriculture, Department of Horticulture, Bornova-Izmir, Turkey.

²Suleyman Demirel Univ., Faculty of Agriculture, Dept. of Agri. Mach. and Techn. Eng, Isparta, Turkey

³Ege University, Faculty of Agriculture, Department of Plant Pathology, Bornova-Izmir, Turkey.

⁴Atatürk Central Horticultural Research Institute, Department of Organic Agriculture, Yalova, Turkey.

*golgen.oztekin@ege.edu.tr

The aim of this experiment was to evaluate composts obtained from by-products of olive oil production as a constituent of growing media and to improve seedling growth with plant growth-promoting rhizobacteria (PGPR) in organic tomato seedling production. Two different kinds of composts including two-phase (2POMW) and three-phase (3POMW) olive mill wastes with separated dairy manure, poultry manure, and straw using aerated static pile composting methods were produced. Compost mainly obtained from 2POMW and 3POMW named as C1 and C2, respectively. C1 and C2 were separately enriched by rock phosphate and potassium salt (EC1 and EC2). In this experiment, 25% and 50% compost rates were selected based on our previous results and used to mix with local peat (LP), respectively. Treated seeds with *Bacillus subtilis* (strain 66/3) and *Pseudomonas fluorescens* (strain 112) were sown on March 07, 2017. Peat (100%) and non-PGPR treated seeds were used as controls. Each treatment had 4 replicates and each replicate included 64 plants in a tray with a volume of 33 cc each. After 3 days in germination room in dark at 24°C, plants were moved to a PE greenhouse which is specialized for seedling growing for post emergence period. Liquid organic fertilizer was used for fertilization. Some physical and chemical properties of each growing medium, germination rate and period, seedling vigor, leaf color and chlorophyll content (SPAD) were determined. The effects of PGPRs and growing media on most measured parameters were found statistically different. The treatment 25% EC1+75% LP mixture gave the highest seedling biomass, germination rate and period followed by 25% EC2+75% LP. Olive mill wastes gave the higher performance on chlorophyll content, seedling height, shoot fresh weight and root and shoot dry weights compared to peat. It was concluded that usage of enriched composts with a rate of 25% could be an alternative to reduce the amount of peat in organic tomato seedling production and their effects can be improved with use of either *B. subtilis* or *P. fluorescens*.

Keywords: PGPR, olive mill wastes, peat, seedling vigour, aerated static pile.





OS 4-5:

CONTAINERIZED ONION TRANSPLANTS: MANAGEMENT STRATEGIES TO ENHANCE GROWTH, YIELD AND QUALITY

Maria A. Macias-Leon, **Daniel Leskovar***

Texas AM AgriLife Reserach , Uvalde Texas 78801, United States of America

*daniel.leskovar@agnet.tamu.edu

In the U.S. most short-day onions are established in the field as direct seeding. With this method, plant stands are typically reduced due to extreme temperatures, weed pressure and soil-borne diseases. Containerized transplants offer an alternative method of stand establishment with less seedling losses while producing uniform bulb sizes and high marketable yield. However, the use of containerized transplants is not a widespread commercial practice in the U.S., mostly due to the higher cost of production. This study aims to select best transplant strategies to improve onion crop performance in the semi-arid region of southwest Texas. The impact of three sequential planting dates (Nov 14, early; Dec 8, mid; and Jan 9, late) and two seedling densities (one seed per cell, T1; three seeds per cell, T3) were evaluated on growth, yield components, bulb quality and phytonutrient content of three onion cultivars ('Caramelo', yellow; 'Don Victor', yellow; and 'Lambada', red). During early development late-transplanted onions had a greater plant height, leaf number and fresh weight, while early plantings required more days to reach maturity than mid and late plantings. Overall, early and mid-transplants resulted in 26% higher yields than late plantings. Although increasing seedling density (T3 vs. T1) did not significantly reduce marketable yield in early plantings, T1 produced a higher number of jumbo and colossal bulb sizes compared to T3. Onion quality was mostly affected by cultivar and not by transplant strategies. The technique of establishing onions from transplants grown from 1 plant per cell (T1) or multiple plants (T3) from early November to early December provides a practical and economical alternative to achieve earlier crops, while reducing the length of the production season comparing to direct seeding.

Keywords: *Allium cepa*, seedling density, short-day onion, stand establishment, transplanting dates





30th International Horticultural Congress

12 - 16 August 2018 • Istanbul - Turkey

SESSION V: Grafting

KEYNOTE 2

ROOTSTOCKS FOR INCREASING YIELD STABILITY AND SUSTAINABILITY IN VEGETABLE CROPS

Francisco Pérez-Alfocea*, Cristina Martínez-Andújar, Alfonso Albacete

Dept. of Plant Nutrition, CEBAS-CSIC, PO Box 164, 30100 Murcia, Spain

*alfocea@cebas.csic.es

Agricultural productivity must increase by 60% to feed the expected population of 9.6 billion people in 2050, while climate change may reduce crop productivity by 80% by the end of this century. Securing food-feed-fiber-fuel production for the growing population will require (i) the breeding of new high-yielding varieties, (ii) closing the gap between potential crop productivity under optimal conditions and the yield captured by farmers under a changing environment, which is termed agronomical stability, and (iii) increasing the socio-environmental sustainability of the natural resources in crop intensification (Albacete et al., 2015). While much recent science has focused on understanding and exploiting root traits as new opportunities for crop improvement, the use of rootstocks has enhanced productivity of woody perennial crops for centuries. Grafting of vegetable crops has developed very quickly in the last 50 years, mainly to induce shoot vigour and to overcome soil-borne diseases in solanaceous and cucurbitaceous crops. In most cases, such progress has largely been due to empirical interactions between farmers, gardeners, and botanists, with limited insights into the underlying physiological mechanisms. Only during the last 20 years has science realized the potential of this old activity and studied the physiological and molecular mechanisms involved in rootstock×scion interactions, thereby not only explaining old phenomena but also developing new tools for crop improvement. Rootstocks can contribute to food security by: (i) increasing the yield potential of elite varieties; (ii) closing the yield gap under suboptimal growing conditions; (iii) decreasing the amount of chemical (pesticides and fertilizers) contaminants in the soil; (iv) increasing the efficiency of use of natural (water and soil) resources; (v) generating new useful genotypic variability (via epigenetics); and (vi) creating new products with improved quality. The potential of grafting is as broad as the genetic variability able to cross a potential incompatibility barrier between the rootstock and the scion. Therefore, understanding the mechanisms underlying the phenotypic variability resulting from rootstock×scion×environment interactions will certainly contribute to developing and exploiting rootstocks for food security. The results obtained so far are very promising.

Keywords: abiotic and biotic stress, grafting, resource use efficiency, root biology, root-to-shoot communication, solanaceae and cucurbitaceae.





OS 5-1:

EFFECTS OF ROOTSTOCKS WITH VIGOROUS ROOT SYSTEM ON GROWTH AND DEVELOPMENT OF PEPPER (*Capsicum annuum* L.) INBRED LINES

Firdes ULAS^{1*}, Halit Yetisir¹, Abdullah ULAS²

¹ Department of Horticulture, Faculty of Agriculture, Erciyes University, Kayseri- TURKEY

² Department of Soil Science and Plant Nutrition, Faculty of Agriculture, Erciyes University, Kayseri-TURKEY

*firdescetin84@hotmail.com

In this study, pepper inbred lines were grafted onto different pepper rootstock genotypes to assess the contribution of grafting to growth performance of grafted plants based on the physiological and morphological response mechanisms under hydroponic conditions in a controlled climate chamber. Four pepper inbred lines (33H-3-1, 21H-1-2, ERÜ462 and ERÜ1227) which were selected from the previous experiment were grafted onto six rootstock genotypes (46 KB F1, 5 MSİVH F1, Scarface, 11B14, Küheylan and E21R10144), while ungrafted scion genotypes were used as control plants. Highly significant ($p<0.001$) differences were found in shoot and root fresh biomass, main stem length, number of leaves, leaf chlorophyll index (SPAD) and total root length among graft combinations. As compared to ungrafted control plants, significantly higher shoot fresh weight, and total leaf number was shown by the graft combination of 21H-1-2/46 KB F1, while significantly longer main stem length was produced by ERÜ1227/11B14. The highest leaf SPAD value was recorded in the graft combination of 33H-3-1/11B14, whereas higher root fresh weight, and total root length were obtained when the same scion was grafted onto a different rootstock (33H-3-1/Küheylan). Overall, the pepper rootstock genotypes 11B14 and 46 KB F1 showed a better performance in shoot and root growth and leaf development in different graft combinations as compared to ungrafted pepper plants. All these suggest that the root power of a vigorous root system plays a major by increasing the graft compatibility between rootstock and scion in grafted pepper plants.

Keywords: Inbred lines, Pepper, *Capsicum annuum* L., Rootstock, Grafting





OS 5-2:

GRAFTING IS A CHANCE OF VEGETABLE PRODUCTION UNDER ABIOTIC STRESS CONDITION IN IRAN

Farzaneh Bekhradi*, Fariba Naghshin

Sepahan Rooyesh, 942, Kashani Ave. Esfahan, Iran

*farzaneh.bekhradi@srooyesh.com

Grafting is widely used in the world for vegetable production. However, commercial use of grafted seedlings in vegetables is new in Iran. Demand for grafted seedlings is increasing due to lack of water and increase soil born disease in arable lands in Iran. Grafting is used to enhance plant tolerance against several abiotic stresses, particularly under suboptimal conditions. In these experiments we tested grafted local melon cultivar Khatoni grafted onto Ferro RZ and Cobalt RZ, eggplant variety Longo RZ grafted onto Conan RZ, King kong RZ and Emperador RZ, cucumber Variety Yalda RZ onto Ferro RZ and Cobalt RZ and tomato variety Sakhia RZ onto King kong RZ and Kaiser RZ in commercial scale. For melon we performed a field experiment during summer 2017 and for the rest in the greenhouses during 2017 - 2018 and in each experiment yield, crop characteristics and sensorial analysis were determined. In melon experiment where, the land is infested with *Fusarium oxysporum*, results showed that grafted melons have better survival rate than non-grafted and increased yield up to 30% compared to the non-grafted melon. Result of sensory analysis showed that grafting did not cause any significant difference in quality characteristic such as aroma, sweetness, and crunchiness or general over view of grafted compared to non-grafted melons. Although results of other crops are still under process, in general grafting is recommended for sustainable production of melon and other vegetables in Iran.

Keywords: salinity, water stress, rootstock, scion, protected cultivation





OS 5-3:

ESTABLISHMENT OF GRAFTED CUCURBITACEAE TRANSPLANTS UNDER MEDITERRANEAN CLIMATE CONDITIONS

Amnon Koren^{1*}, Eyal Klein²

¹22nd Yarden Street, Moshav Nehalim 49950, Israel Thailand

²Hishtil Ltd., Head Office, 22nd Yarden Street, Moshav Nehalim 49950, Israel

*amkor52@gmail.com

The Mediterranean climate is characterized by a long, hot summer with little precipitation, followed by a relatively short winter that is either dry with little rain or rich in precipitation from short rainstorms. During most of the year, the level of radiation is high, and these conditions may hamper the production and establishment of grafted *Cucurbitaceae* seedling. The quality of seeds and seed health are both critical for the health and quality of the grafted plant components – rootstock and scion. Undetectable amounts of infected seeds in a seed-batch may constitute a source of pathogenic inoculum and spread of diseases. Environmental conditions and high radiation, high or low soil temperatures should be considered when choosing the right soil mulch for transplant establishment, as well as net cover to avoid contamination of pests before and during transplanting. Adequate seedling production and afterwards adjusted transplanting depth will help to avoid scion bypass through adventive rooting that eliminate rootstock advantages. Controlling soil salinity, leaching and aeration enables sufficient rooting after transplanting. Rootstock performance and compatibility to scion support high yields and quality; it was evaluated in field plots which were infested with cucumber green mottle mosaic virus (CGMMV). This virus constitutes a significant threat to cucurbits production, as well as a variety of other pests which are intensified by the Mediterranean climate. The Nurit rootstock, resistant to CGMMV, was tested to improve yield and quality of cucumber and watermelon varieties, under net-house conditions, during 2013-2015. Increased 'King-star' cucumber yield by up to 25% was found in plants grafted on Nurit rootstock, comparing to other commercial rootstocks such as Triumph. Different watermelon varieties, Talka, Maxima and Fascination which were grafted onto Nurit rootstock yielded similarly to the commercial rootstocks, and were prominent in the quality indices examined.

Keywords: grafting, transplant establishment, cucurbit rootstock, crop protection





IHC2018-Symposium 35

VIII International Symposium on Seed, Transplant and Stand Establishment of Horticultural Crops

POSTER PRESENTATIONS

P-1:

EFFECT OF NITROGEN CONCENTRATION AND POT VOLUME ON PEPPER (*Capsicum annuum* L.) AND EGGPLANT (*Solanum melongena* L.) SEEDLINGS DEVELOPMENT

Dumičić Gvozden^{1*}, Marin Cukrov², Lemić Gašpar², Katja Žanić¹, Branimir Urlić¹

¹Institute for Adriatic Crops and Karst Reclamation, Split, Croatia

²University of Split, Study on Mediterranean Agriculture, Split, Croatia

*gdumicic@krs.hr

Effect of nitrogen concentration and pot volume were studied on morphological traits of pepper and eggplant seedlings using Ebb & flow fertigation system. Four different nitrogen (N) concentrations (35, 70, 140 and 205 mg L⁻¹ N) and pot volumes (35, 45, 60 and 80 mL) were used to investigate their influence on seedlings vegetative development. Seedlings with developed cotyledons were irrigated with different nutrient solutions for 24 h, and kept dry for 48-72 h depending of seedlings stage. Results indicated that the overall height, number of leaves and leaf area were affected by both factors. The tallest pepper seedlings were obtained at N concentrations of 70 and 205 mg L⁻¹ (23.67 and 23.51 cm), while pot volumes of 45 and 80 mL achieved the best result with both species. Seedlings grown in 80 mL pots had highest number of leaves regardless of N concentrations. However, using N concentrations of 140 mg L⁻¹, number of leaves increased regardless of pot volume. Leaf dry weight and area of both species were increased by increasing N concentration and pot volume. An increase of pot volume from 35 to 80 mL had positive effect on leaf thickness of both species seedlings. Nitrogen concentration increase and pot volume decrease resulted in overall increase of specific leaf area. Nitrogen concentrations of 140 and 205 N mg L⁻¹ resulted with highest chlorophyll concentration index on both species. Nitrogen concentration of 140 mg L⁻¹ and pot volume of 80 mL ensured best seedling development for both species.

Comment [KZ1]: Ova uvlaka je 1

Keywords: chlorophyll concentration index, Ebb & Flow fertigation system, leaf thickness, leaf area, Solanaceae

Comment [KZ2]: Čini mi se da tre bit 5 klju. riječi





30th International Horticultural Congress

12 - 16 August 2018 • Istanbul - Turkey

P-2:

SEED TREATMENT WITH TRYPTOPHAN IMPROVES GERMINATION AND EMERGENCE PERFORMANCE OF PEPPER UNDER SALINITY STRESS

Ahmet Korkmaz^{1*}, Ayşe Gereklî¹, Gökçen Yakupoğlu², Aygöl Karaca¹, Şebnem Köklü¹

¹Kahramanmaraş Sütçü İmam University, Dept. Of Horticulture, Kahramanmaraş, Turkey

²Bozok University, Yozgat, Turkey

*akorkmaz@ksu.edu.tr

In this research, enhancing salinity stress tolerance in pepper (*Capsicum annuum* L.) during seed germination by tryptophan applications was investigated. In order to improve germination and emergence under salinity stress, pepper seeds were treated with tryptophan in various concentrations (0, 1, 10, 100 and 1000 µM), after which they were subjected to seed germination and seedling emergence tests at optimum (0 mM NaCl) and saline (150 mM NaCl) conditions. The results indicated that pre-sowing seed treatment with tryptophan could enhance germination and emergence performance of pepper seeds under salinity stress conditions, and of the tryptophan concentrations tested, treating the seeds with tryptophan in the range of 1-100 µM was highly effective giving the highest germination and emergence percentages. Additionally, tryptophan application also enhanced the activities of antioxidant enzymes while reducing tissue H₂O₂ and MDA concentrations. Therefore, tryptophan, which is the precursor of a broad spectrum antioxidant- melatonin, could be used effectively in enhancing seed germination and seedling emergence performance of pepper under salinity stress conditions.

Keywords: pepper, tryptophan, seed germination, stress tolerance, salt stress





P-3:

EFFECTS OF PLANT GROWTH-PROMOTING RHIZOBACTERIA COMBINED WITH COMPOSTS OBTAINED FROM ROSE OIL PROCESSING WASTES ON ORGANIC TOMATO SEEDLING PRODUCTION

Gölgün Bahar Öztekin^{1*}, Yüksel Tuzel¹, Kamil Ekinci², Hatice Ozaktan³, Gülay Besirli⁴

¹Ege University, Faculty of Agriculture, Department of Horticulture, Bornova-Izmir, Turkey.

²Süleyman Demirel Univ., Faculty of Agriculture, Dept. of Agri. Mach. and Techn. Eng, Isparta, Turkey

³Ege University, Faculty of Agriculture, Department of Plant Pathology, Bornova-Izmir, Turkey.

⁴Atatürk Central Horticultural Research Institute, Department of Organic Agriculture, Yalova, Turkey.

*golgen.oztekin@ege.edu.tr

The objective of this experiment was to test the performance of compost in organic growing medium with plant growth-promoting rhizobacteria (PGPR) for organic tomato ('Rio Grande') seedling production. The study was conducted during the spring season of 2017. Two different composts previously obtained from a mixture containing rose oil processing wastes, separated dairy manure, poultry manure, and straw composted by two methods (aerated static pile: ASP and turned windrow: TW) and their mixtures (1:1 and 1:3, v/v) with local peat (LP) were used as growing medium. Seeds treated with *Bacillus subtilis* and *Pseudomonas fluorescens* were sown on March 07, 2017. Peat and non-PGPR treated seeds were used as controls. All media were sifted before use. After 3 days in germination room, seedlings were moved to a PE greenhouse which is specialized for seedling growing. Liquid organic fertilizer was used for fertilization. Some physical and chemical properties of each growing medium, germination rate and period of seeds, seedling vigor, leaf colour and chlorophyll content (SPAD) were determined. The effects of PGPR on most measured parameters were found statistically different. Among the tested PGPRs, *B. subtilis* improved seed germination rate and vigour, reduced germination period and leaf chlorophyll content. Based on the seed vigour test, peat and compost produced from ASP showed better performance and were found comparable. This study concluded that compost produced from ASP can be used in organic tomato seedling production and *B. subtilis* x 50% compost-ASP+50%LP was found to be more promising one based on the measurements regarding plant growth.

Keywords: *Bacillus subtilis*, *Pseudomonas fluorescens*, peat, compost, seedling vigour





P-4:

IMPROVEMENT OF SEED GERMINATION OF CAPPER (*Capparis spinosa* L.) Through Magnetic Fields

Mariano Juan, Nuria Pascual-Seva, D.aniel Iranzo, **Bernardo Pascual***

Departamento Producción Vegetal. Universitat Politècnica de València. Camí de Vera, s/n, 46022 Valencia, Spain.

*bpascual@prv.upv.es

Caper is a sub-shrub mainly used for its flower buds, essentially in food, but also in the pharmacological industry. The poor germination capacity of caper seeds in field conditions has been cited as one of the greatest restrictions to the expansion of this crop. Several publications indicate that caper seeds present both physiological and physical dormancy. The exposure of seeds to stationary magnetic fields is a technique that has shown improvements on germination percentages and early seedling growth for different plant species; however, it is one of the least applied techniques. This experiment was designed to evaluate the effect of different intensities (0, 125 and 250 mT) and exposure times (1 h, 24 h and chronic exposure) of magnetic fields on caper seed imbibition, germination and radicle growth. The germination test was performed using the ISTA BP method, using water and gibberellic acid (500 mg L^{-1}) as humectant for the substrate. Once the seeds germinated, the growth of the seedlings was periodically determined using an image analysis software. The exposure of caper seeds to magnetic fields increased their water imbibition, reaching values of seed moisture (39.5%) higher than the control (31%). Among the analyzed treatments, the highest germination percentage was obtained with both chronic exposure to 125 mT (82%) and 24 h exposure to magnetic fields of 250 mT (75%), while the germination of the control treatment was 57%. The positive effect of magnetic field exposure on seed germination only occurred with the addition of gibberellic acid to the substrate. As for radicle growth, the longest radicle was obtained by exposing the seeds 24 h to magnetic fields of 250 mT and with the chronic exposure of the seeds to both magnetic fields.

Keywords: physical and physiological dormancy, imbibition, seedling growth





P-5:

HYDRO-ELECTROSTATIC HYBRID PRIMING EXCAVATES THE POTENTIAL VIGOR OF ONION SEEDS

Danfeng Huang*, Yinglei Zhao

800 Dongchuan Road, Shanghai Jiaotong University, 1-211, Building of Agriculture Biology, Shanghai, 200240, China

*hdf@sjtu.edu.cn

Onion (*Allium cepa*) seeds gradually lose vigor even in optimal storage conditions. Some of the vigor loss were reversible and could be recovered by priming. Hydro-priming is widely and conventionally used for its non-chemical involved clean processing, but longer priming time and precisely seed moisture control are required. Electrostatic field irradiation could instantly and significantly elevate seed vigor and accelerate germination, however, it has a few disadvantages one of which is short effective time where the elevation could be lost in one month. So, electro-priming and hydro-priming were combined to a novel priming technique called Hydro-Electrostatic Hybrid Priming (HEHP), where the process of hydro-priming could be accelerated by electrostatic field irradiation and higher seed vigor and precise seed moisture control were achieved without any chemicals agents. Techniques liked CD spectroscopy, EPR, SEM and TEM were utilized to explain the mechanism of hybrid priming and we found that electrostatic field irradiation enhanced the activity of superoxide dismutase enzyme (SOD) by changing its structures. Thus, free radicals were scavenged more efficiently and it helped self-healing of organelles and plasma membrane of embryo cell was more complete in priming process.

Keywords: electric field, hydro, hybrid, priming, seed





P-6:

EFFECTS OF DIFFERENT TREATMENTS AND AGING ON SEED GERMINATION OF PEPPER

Ya Zhao^{1*}, Yu-yu Chou², Yung-kuang Huang²

¹55 Hwa-Kang Rd., Yang-Ming-Shan, Department of Horticulture, Chinese Culture University, 11114 Taipei, Chinese Taipei

²P.O. Box 42, Shanhu, The World Vegetable Center, 74199 Tainan, Chinese Taipei

*tkzczy@gmail.com

The seeds of pepper (*Capsicum annuum* L.) in Genebank were routinely cleaned, dried and packaged prior to storage. The basic flow process on how to handle the seeds are defined by the Manual of Seed Handling of Genebanks. In order to compare the relative germination rate of different accessions and to evaluate the effects of various pretreatments on the longevity of seeds, the peppers were subjected to 6 treatments. Three different pepper accessions (VI048636, VI039379 and VI038164, origin from The World Vegetable Center in Tainan, Taiwan) were subjected to five aging times to examine their effects on seed germination. The treatments include medical treatment (T) using 0.5N hydrochloric acid (HCl) and 10% Tri-sodium Phosphate (TPS), high temperature treatment (H) that 80°C for 24 hours in oven, distilled water treatment (W), medical treatment combined with high temperature treatment (TH), distilled water treatment combined with high temperature treatment (WH) and control without any treatment (CK). After treatments, seeds were aged in 41°C and 100% relative humidity(RH) water bath for 0, 1, 2, 3, 4 days before germination tests on top of paper (TP). Standard Germination Test (SGT) was done according to the standard procedures developed by International Seed Testing Association (ISTA, 2014). Both germination rate and development of VI039379 were significantly higher than VI038164 and VI048636. High temperature treatment was lethal to the seeds of all varieties. All germination rates subjected to high temperature treatment were below 50% regardless of aging time or varieties.

Keywords: seed, treatments, storage, pepper, germination, aging





P-7:

EFFECTS OF DAILY LIGHT INTEGRAL DURING PLUG SEEDLING STAGE ON GROWTH AND SUBSEQUENT FLOWERING OF LISIANTHUS

Der-Ming Yeh*, Chia-Yun Chang

Dept Horticulture & Landscape Architecture, No. 1 Sec 4 Roosevelt Rd, Taipei 106, Chinese Taipei

* dmyeh@ntu.edu.tw

Daily light integral (DLI) during the seedling stage may strongly affect growth and subsequent flowering in ornamental plants, especially for Lisianthus [*Eustoma grandiflorum* (Raf.) Shinn.] plug production (from sowing to 3-4 leaf-pair stage) that requires approximately 2 months. In this study, Lisianthus 'Clariss Pink' seedlings at unfolded cotyledon stage were grown at 25/20°C under 8, 12, or 16 h photoperiod conditions. Seedlings were treated with eight DLIs from 2.9 to 17.3 mol·m⁻²·d⁻¹ with white light emitting diode (8 red : 1 blue). As reached 3-4 leaf-pair stage, they were transplanted to 17.3 mol·m⁻²·d⁻¹ (16 h) until flowering. Results showed that leaf width, leaf thickness, and root activity (TTC method) increased with increasing DLI and plateaued between 11.5 and 13.0 mol·m⁻²·d⁻¹. Leaf area, leaf initiation rate, and plant dry weight increased linearly, while specific leaf area and time to transplant decreased with increasing DLI. Seedlings raised at 11.5 mol·m⁻²·d⁻¹ or higher DLIs resulted in faster plug production and flowering. However, prolonged treatments with high DLIs and a long photoperiod (16 h) should be avoided as premature flower induction might occur during young non-juvenile seedlings and thus reducing both the leaf number below the first flower and possible cut flower length.

Keywords: photoperiod, transplants, juvenility, LED





30th International Horticultural Congress

12 - 16 August 2018 • Istanbul - Turkey

P-8:

THE EFFECTS OF LOCAL VACUUM SEALING TREATMENTS ON DIVERSE SEED TYPES IN TROPICAL SOUTHEAST ASIA

Abram Bicksler^{1*}, Patrick Trail², Yuwadee Danmalidoi²

¹ ECHO Asia Impact Center, PO Box 64, Muang, Chiang Mai 50000, Thailand

² 2705 Tung Hotel Soi 6, Wat Ket, Chiang Mai 50000, Thailand;

*abram.bicksler@gmail.com

Seed is a vital input for agricultural productivity worldwide. Seed saving in the humid tropics for smallholder farmers and communities is confounded by the high relative humidity and lack of access to high-tech seed storage methods. Research was conducted in Chiang Mai, Thailand, and the Arawaddy Delta of Myanmar to test the ability of local vacuum sealing treatments that are low-cost and accessible to conserve stored orthodox (vegetable and rice) seed viability in the humid tropics. A low-cost seed germination cabinet was also created to test seed germination rates. This research found that use of low-cost vacuum sealing on diverse seed types (vegetables and grains) in the humid tropics preserved seed germination rates up to 40% better than the control over the course of a year. When coupled with low-tech temperature stabilization approaches using appropriate structures, this low-cost vacuum sealing approach may have potential to help smallholder farmers and their respective communities across the world to help save valuable agricultural inputs and biodiversity.

Keywords: seed saving, vacuum sealing, appropriate seed banking, Southeast Asia





P-9:

THE INFLUENCE OF STORAGE TEMPERATURE, HUMIDITY AND SEED PELLETING ON CABBAGE SEEDS QUALITIES AND COMMODITY SEED LONGEVITY

Jingjin Zhang, Yihang Zhu, Yinglei Zhao, Xueqin Pan, Danfeng Huang*

800 Dongchuan Road, Shanghai Jiao Tong University, 0-507, Building of Agriculture Biology, Shanghai, 200240, China

*hdf@sjtu.edu.cn

Cabbage seeds are usually sensitive to storage temperature and humidity. Commodity cabbage seeds are usually stored extensively in woven bags in warehouses with steady temperature and relative humidity (RH) around 8~15°C and 30~55% respectively, which causes a trade-off between seed quality preservation and energy saving. Pelleted seeds have shown to have better seedling performance than normal seeds yet perform worse in storage than raw seeds. This study investigated the effect of temperature and RH on seedling quality and seed longevity of cabbage using seed (*Brassica oleracea* var. *capitata* L.) with and without pelleting. Germination, vigor and moisture content were investigated via the saturated salt accelerated aging (SSAA) tests. In addition, the seed longevity under different commodity warehouse conditions were estimated by simulating the experimental data based on Ellis' seed longevity predict equation. The results showed that storage temperature and RH have significant influence on seed germination, vigor and moisture content. The pelleted seeds have significantly higher moisture content than normal seeds. The results suggest that for commodity cabbage seeds, compared with previous equilibrium moisture content models like M. Henderson and GAB (Guggenheim-Anderson-de Boer), it is more convenient to determine seed moisture content rapidly from storage temperature and RH in a certain range for decision-making purposes, of which the accuracy is not sacrificed. Moreover, the influence of different warehouse temperature and RH on cabbage seed longevity (more than a year) is remarkable between seeds with and without pelleting.

Keywords: Cabbage seeds; storage condition; seed pelleting; commodity seed; seed longevity





P-10:

PRETRANSPLANT-N CONCENTRATION OF THE NUTRIENT SOLUTION INFLUENCES GROWTH AND YIELD OF HYDROPONIC LETTUCE CULTIVARS

Desire Djidonou, **Daniel Leskovar***

1619 Garner Field Rd., Texas A&M AgriLife Research, Texas A&M University, Uvalde Texas 78801, USA

* daniel.leskovar@agnet.tamu.edu

Optimum growth and marketable yield of lettuce (*Lactuca sativa* L.) can be greatly affected by an array of factors including nutrient management during the early transplant plug production period. The objective of this study was thus to evaluate growth and yield of lettuce seedlings produced with different nitrogen fertilization rates during the nursery stage. Seed of six lettuce cultivars were grown with six pre-transplant N fertilization rates (0, 50, 100, 150, 0-50-100, and 100-150-200 mg L⁻¹) for three weeks during Fall and Winter seasons. Seedling growth parameters were evaluated and afterwards, they were transplanted into a recirculating nutrient film technique (NFT) production system inside a greenhouse, where they were grown with a complete optimum nutrient solution containing a constant 200 mg L⁻¹ N fertilizer. Initial growth traits including leaf area, dry weight and leaf number of transplants produced with nutrient-less (0 mg L⁻¹) solution were significantly decreased compared to those grown with nutrient-available solutions. The low seedling vigor of the nutrient-less control did not recover after transplanting into the optimum nutrient solution. Overall, a significant N rate × cultivar interaction occurred on marketable yield, shoot dry weight, leaf number and leaf area index. Most notably, maximum fresh yields, ranging from 2.5 to 5.8 kg m⁻², were achieved on seedlings grown with a constant pre-transplant 50 mg L⁻¹ N solution for cvs. Annapolis, Dagoon, Holon, and Sparx, while cvs. Buttercrunch and Green Forest recorded maximum yields of 4.1 and 6.8 kg m⁻², respectively with a pre-transplant N concentration of 150 mg L⁻¹. These results clearly suggest that a pre-transplant nutrient solution of 50 to 150 mg L⁻¹ N could be sufficient to ensure optimal post-transplant growth leading to a maximum crop productivity of lettuce plants in a recirculating hydroponic system.

Keywords: *Lactuca sativa*, hydroponics, nutrient film technique, transplant quality, nitrogen fertilization





30th International Horticultural Congress

12 - 16 August 2018 • Istanbul - Turkey

P-11:

GROWTH AND DEVELOPMENT OF PEPPER (*Capsicum annuum* L.) INBRED LINES AS AFFECTED BY ROOTSTOCKS WITH VIGOROUS ROOT SYSTEM UNDER SALT STRESS

Firdes Ulas^{1*}, Omar M. Al Rubaye¹, Halit Yetisir¹, Abdullah Ulas²

¹Department of Horticulture, Faculty of Agriculture, Erciyes University, Kayseri- TURKEY

²Department of Soil Science and Plant Nutrition, Faculty of Agriculture, Erciyes University, Kayseri-TURKEY

*firdescetin84@hotmail.com

In this study, pepper (*Capsicum annuum* L.) inbred lines were grafted onto different rootstock genotypes and tested under saline conditions. The climate chamber experiment was carried out to determine plant growth, main stem length, leaf chlorophyll content (SPAD), leaf number, shoot and root fresh weights, as well as root length. Two pepper inbred lines (ERÜ 462 and ERÜ 1227) were grafted onto three rootstocks (Scarface, 11B14 and E21R10144) and grown in 8 L pots filled continuously aerated nutrient solution under saline conditions (8 dS m⁻¹) with three replications. The results indicated that strong rootstock promoted plant growth in pepper plant both under control and saline conditions and significant depression of plant biomass production under saline conditions was observed in both grafted and non-grafted control plants. Scarface and 11B14 rootstock genotype were found more tolerant to salinity than non-grafted pepper plants and the other genotypes used as regard to investigated parameters.

Keywords: salt stress, inbred lines, pepper, *Capsicum annuum* L., rootstocks, grafting





30th International Horticultural Congress

12 - 16 August 2018 • Istanbul - Turkey

P-12:

SEED GERMINATION AND EMERGENCE OF TWO *CYRTANTHUS* SPECIES

Nonkosi Sibande, Riana Kleynhans, **Babalwa Matsiliza-Mlathi***

Department of Horticulture, Tshwane University of Technology, Pretoria, South Africa

*matsiliza-mlathib@tut.ac.za

Cyrtanthus is a highly decorative genus from the Amaryllidaceae family consisting of approximately 60 species endemic to the southern and eastern parts of Africa. To optimise sexual propagation methods three consecutive experiments were conducted to investigate the effect of temperature, seed age, seed pre-treatment and media on the germination of *Cyrtanthus mackenii* and *C. epiphyticus* seed. The best germination was observed at 20 °C although it did not differ significantly from other temperature treatments. Younger seed (less than 6 months from harvesting) germinated better than older seed. Seed pre-treatment (including smoke water) applications did not significantly improved the germination percentage.

Keywords: germination temperature, smoke water, germination media





P-13:

DO SEED HARVEST PERIOD AND DRYING METHOD AFFECT THE SEED QUALITY AND YIELD IN ONION?

Gulgun Baslar¹, Hülya İlbi^{2*}

¹ AXIA Tohum, Kepez, Antalya, Zeytinlik Mah. 7765 Sok. No1, Antalya, Turkey

²Ege University, Faculty of Agriculture, Dept. Of Horticulture, 35100 Bornova Izmir, Turkey

*hulya.ilbi@ege.edu.tr

The aim of this study was to investigate the effects of different harvest periods and drying methods on onion seed quality and yield. The umbels were harvested 35, 50 and 65 days after 50 % of bloom on the umbels (DAB). Then, harvested umbels were dried in the sun and in the shade. Germination and controlled deterioration tests were used for determining the seed quality. The seed yield/umbel (g) and seed yield/da (kg) were calculated for yield evaluation. Drying methods affected on seed viability and the highest germination percentage (96.7 %) was obtained from drying in the shade. The seed vigour did not significantly vary by harvest dates when umbels were dried in the shade. On the other hand, harvest dates following drying in the sun had significant effect on seed quality and the seeds harvested 50 DAB had the highest seed vigour (97 %). Although there was no effect of harvest dates and drying methods on seed yield/umbel (g), drying in the shade (107.374 kg) had significant effect on seed yield/ da (kg).

Keywords: seed, onion, harvest period, seed quality, drying methods





P-14:

ESTABLISHMENT OF SEEDLING PREPARATION AND TRANSPLANTING METHODS FOR MACHINE-BASED TRANSPLANTING IN ONION (*Allium cepa* L.)

Seongjun Kim*, Younsup Cho, Yasung Lee, Hyojoong Kim

Jeollanam-do Agricultural Research and Extension Services, Naju, 520-715, Korea

*kim7366@korea.kr

Global onion production has grown continuously in recent years, so the total production was estimated as 93.2 million tons in 2016. This gradual increase in the production and consumption of onion is because it is not only conventionally important seasoning vegetables but also recently known health benefits such as cancer, diabetes, high blood pressure, etc. In Korea, onion is the third largest vegetable industry, which is grown in 19,538 ha and its annual production is 1,144,493 tons. However, Korean onion industry is in crisis due to high production costs and labor shortages. In order to break through these issues, some comprehensive approaches are tried and the introduction of onion-transplanter may present a good solution to this. However, the current seedling system is not fitted to the newly developed onion-transplanter. This study was performed to establish seedling management system for new transplanter in onion from seed germination, seedling days determination, irrigation and fertilizer planning, etc. To achieve good seedling preparation before transplanting, fine seeds selection process was necessary and seed flotation led to 98% germination in water bath. The optimal date for seedlings preparation suitable for transplanting was confirmed as 60 to 65 days after sowing and the characteristics of most seedlings was like followings ; 3.5cm in bulblet diameter, 2.5 in number of leaf, 15 in number of roots. The proper irrigation scheme was suggested as 2 times per day during the first 0 ~ 3 weeks after sowing, 1 times per day during 4 ~ 9 weeks (the irrigation amount was 700~800ml per 1 time). For the fertilization onto the seedling, 3 times spray of 56% nitrogen (700ml per seedling plate at a time) at 4, 6, 8 weeks after sowing has shown the best result. Meanwhile, the optimal sowing depth for transplanting was confirmed as 3cm. This new seedling management system will be used as basic information for onion-transplanter.

Keywords: Onion (*Allium cepa* L.), transplanter, transplanting machine, seedling culture, production costs, labor

