SCBGP PROJECT PROFILE TEMPLATE

DEFINITION OF A PROJECT

A project is a set of interrelated tasks with a cohesive, distinct, specified and defined goal. It follows a planned, organized approach over a fixed period and within specific limitations (cost, performance, quality, etc.). Additionally, it uses resources that are specifically allocated to the work of the project and usually involves a team.

Projects are different from other ongoing operations in an organization because, unlike operations, projects have a definitive beginning and end – they have a limited duration. One way to think about this is that a project has an overarching goal that you want to accomplish through a series of individual activities or tasks. Examples of projects could include researching new cultivars or marketing apples through a targeted promotional campaign.

Activities or tasks that could be a part of such projects might include hiring personnel, purchasing special equipment, holding an educational workshop, planting specialty crops or distribution product promotional materials.

INSTRUCTIONS

1. Complete the profile below, describing how you will fulfill the goals and objectives of your project and provide key details.
2. Transfer data to the related sections in the ISDA online GMS system under your account for this opportunity.

PROJECT TITLE

Provide a descriptive project title in 15 words or less in the space below.

Increasing Productivity & Consumer Accessibility of Hydroponically Grown Organic Lettuce in Indiana

DURATION OF PROJECT

Start Date: 10/1/2021 **End Date**: 9/30/2024

PROJECT PARTNER AND SUMMARY

Include a project summary of 250 words or less suitable for dissemination to the public. A Project Summary provides a very brief (one sentence, if possible) description of your project. A Project Summary includes:

1. *The name of the applicant organization that if awarded a grant will establish an agreement or contractual relationship with the State department of agriculture to lead and execute the project,*
2. *A concise outline the project's outcome(s), and*
3. *A description of the general tasks to be completed during the project period to fulfill this goal.*

FOR EXAMPLE:
The ABC University will mitigate the spread of citrus greening (Huanglongbing) by developing scientifically-based practical measures to implement in a quarantine area and disseminating results to stakeholders through grower meetings and field days.

Many hydroponic growers in Indiana are converting to organic farming, expecting higher profits. Organic production is characterized by low productivity and variable crop yields due to decreased and variable nitrogen

availability to crops. In addition, a select group of consumers have access to organically grown produce due to premium prices. These inequitable factors increase risk and negatively affect sustained profits in organic hydroponics industry. Crop productivity and yield stability should improve for sustained profits in organic hydroponics industry. This will further lower price of organically grown produce and make it more affordable to all consumers. Increased sales and diverse consumer base are key to sustained profits. Purdue University will develop technologies that will aid in increasing nitrogen availability to crops to improve crop productivity and yield stability in organic hydroponics industry. In addition, Extension workshops geared towards educating Indiana growers with developed technology will be implemented. The hydroponics technology will be displayed at 16 Tech Innovation District (Indianapolis) for maximum visibility. Workshop programming will include getting started with home hydroponics, the environmental benefits associated with hydroponics, the promotion of the nutritional value of leafy green consumption in the diet, cooking and storage of leafy greens, and promotion of the health benefits of organically grown produce with a focus on serving underappreciated communities facing food insecurity.

PROJECT PURPOSE

PROVIDE THE SPECIFIC ISSUE, PROBLEM OR NEED THAT THE PROJECT WILL ADDRESS

Hydroponic lettuce industry is rapidly growing in Indiana mainly due to higher income from year-round production, increased demand for locally grown food, and nearness to many urban markets. Recently, many hydroponic lettuce growers in Indiana are converting their conventional hydroponics to certified organic production. This is because of increased demand for organically grown foods, especially vegetables and fruits, due to their health benefits [1]. Moreover, lettuce ranks first among the organically grown vegetables sold in the US with a wholesale value of $400 million in 2019 (44% increase from 2016) [2], which further attracts hydroponic lettuce growers.

The proposed research and engagement activities address two unique but interdependent issues: (i) low yield, variable profits, and increased risk in Indiana organic hydroponics industry and (ii) food insecurity and poor food choices causing elevated health risks in Indiana communities

(i). Organic hydroponics industry is challenged by low and variable crop yields compared to conventional agriculture [3, 4] and high premium price/ narrow customer base for organically grown produce, resulting in increased risk and low profits. For example, yield of organically grown lettuce was 14% lower compared to lettuce yield in conventional farming [4]. A recent study showed that premiums paid for organically grown produce is 29 to 32% compared to conventionally grown produce [5]. In spite of higher demand for organically grown produce, the market is mainly limited to select group of consumers who can afford premium prices. High premiums are less attractive to mainstream consumers.

Decreased and variable nitrogen (N) availability to plants is one of the main reasons for low crop productivity and variable yields in organic farming [3, 6, 7]. Organic farming uses fertilizers containing complex molecules (e.g. proteins from plants and animals), which release N due to microbial action. The release of N from organic fertilizers can be slow and may not synchronize with peak crop growth [3, 6, 7] leading to suboptimal N levels in the plant, and subsequent yield losses. Moreover, the price of organic fertilizers used in hydroponic systems is much higher (2-3 times) than inorganic fertilizers. It is critical to manage plant N status at optimal level to maximize and stabilize yield in organic hydroponic industry. In addition, fertilizer application should be based on crop growth to minimize wastage in organic farming. Continuous monitoring and application of N fertilizer at the right time is needed to maintain optimal plant N status, high productivity, and stable yield in organic farming. Currently technologies that can continuously monitor and aid in maintaining optimal plant N status are unavailable for organically grown crops in hydroponic production.

Lack of access to healthy organic produce due to price is a food justice issue. A diverse consumer base is essential for sustained profits in any industry. Industry targeted to select group of consumers can be risky,

especially when economic growth becomes slow due to unforeseen factors. Increased crop productivity will increase sale volume, lower crop prices, and enable organically grown produce more affordable to all consumers. As the premium needed for profits in organic farming is only 5 to 7% [5], organic production will be profitable even with a significant drop in the sale price.

(ii). Approximately 65% of adults, 30% of youth (10-17 years of age) and 29% of high school students in Indiana are overweight or obese [8] and this places them at an elevated risk for other health complications. The costs are staggering in terms of the burden on the health care system, lost productivity and quality of life. In part, the overweight/obesity problem stems from food insecurity, which affects almost 20% of Indiana children [9]. This is mostly due to poor food choices. Coupled with energy excess, the poor food choices lead to specific nutrient excesses (e.g., salt) and deficiencies (e.g., fiber, folate, magnesium, calcium, iron) that are associated with an array of chronic health disorders such as hypertension, cancer, and osteoporosis. Leafy vegetables like spinach, lettuce and arugula are among the top vegetables that are rich in 17 nutrients of public health importance [10]. Educating consumers about nutritional benefits of leafy greens, environmental benefits of hydroponics, and health benefits of organic farming can increase consumption and interest in organically grown leafy greens. Centers for Disease Control and Prevention recommends a holistic community approach that not only provides food access but also education that will lead to increased healthy food consumption [11].

We propose to develop research-based technologies for monitoring plant N status, training Indiana hydroponic growers with the new technology and crop management strategies using Extension workshops, and engaging in community education about nutritional benefits of leafy greens, environmental benefits of hydroponics, and health benefits of organic farming. The outcomes expected are stable yields and profits in organically grown hydroponic lettuce, increased consumption of organically grown and healthy leafy greens in Indiana communities, and increased interest to grow organic produce in local communities leading to decreased food insecurity.

Research.

Two types of technologies and relevant software will be developed for monitoring plant N status. One will be based on low-cost microcontrollers interfaced to cameras ($200 each, Fig. 1a) and other will be based on smartphone apps (Fig. 1b). The microcontroller technology will be suitable for medium and large-scale production, while smartphone apps can be used in small-scale operations. We will leverage published research [9] from PI's laboratory that uses plant images to measure an image-derived N-index [Fig. 2]. The N-index is related to plant N status [12]. The microcontroller with camera acts like an IoT (Internet of Things) sensor. It captures and transfers plant images to a central computer. Several images can be processed on the central computer. Smartphone cameras can be used to capture and instantaneously process images. We will develop user-friendly software based on the logic in the published research [12] but using platforms that are more compatible to microcontrollers and smartphone apps (e.g. C++).

Technology validation experiments will be conducted inside the horticultural greenhouse complex at Purdue University in West Lafayette. The experiments will compare two hydroponic treatments including technology-based (both microcontroller and smartphone) organic lettuce production (hereafter 'test' treatment) and conventional (without technology use) organic lettuce production (hereafter 'control' treatment). Plants will be grown for four weeks in 10 cm wide containers filled with a soilless organic substrate comprising of peat, vermiculite, and perlite. The substrate in the test and control treatments will be incorporated with soy and animal meal protein. In addition, these treatments will receive a water-soluble organic fertilizer (Bombardier 8-0-0, Kimetic Group) during production. The supply of organic water-soluble fertilizer will be based on plant N status measured by the micro-controller and smartphone (i.e., when plant N drops below a threshold) in the test treatment. Whereas organic water-soluble fertilizer will be supplied daily during weeks 3 and 4 in the control treatment (i.e. normal practice). We will grow four lettuce varieties belonging to butter head, leaf, romaine, and oakleaf groups from organic seed in both treatments. We will follow standard organic production practices recommended by National Organic Program (USDA). Plants will be irrigated with a drip system interfaced to fertilizer injectors to deliver the required concentration of organic water-soluble fertilizer to plants. The injector will be dialed to supply a concentration of approximately 0.7 ml of organic fertilizer/ L (700 ppm) of nutrient

solution, based on previous research [13]. We will measure total fertilizer supplied to plants, amount of fertilizer leached from containers or wasted, and crop yield in both treatments and for each variety. The research will be conducted during spring, summer, fall, and winter seasons and for two years to measure yield stability. Experiments will be setup as split-plot designs and data will be analyzed using a linear-mixed model. The least-square means will be separated using Tukey's honestly significant difference (HSD) procedure (P-value ≤ 0.05).

Engagement.

The Extension program comprises of different components to directly address the issue of hydroponics educational needs of growers, and nutrition education and increased consumption of healthy foods. We will use the established hydroponic workshops at Purdue University (these workshops are a product previous support from ISDA SCBGs to Dr. Nemali) to share research-based information, education materials, and train Indiana hydroponic growers and county Extension Educators with developed technology. We will showcase the technology prominently within The Artisan Marketplace (The AMP), a public culinary showcase and food court, within 16 Tech Innovation District to foster community engagement (Fig.3). In the area surrounding the 16 Tech Innovation district, healthy food consumption statistics are startling, with more than 75% of the adult population consuming less than the recommended amounts of fruits and vegetables [14]. The AMP display will be located within a forty-foot shipping container designed to spark interest in hydroponics gardening, increase knowledge regarding the impact of healthy food consumption, and provide education on the environmental benefits of hydroponics and organic growing through interactive technology, signage, and program leaflets. We will utilize the hydroponics display and area within The AMP to provide equitable, educational programming for low-income adults and k-12 students (support letter attached) most likely to be experiencing food insecurity annually. The hydroponics display at The AMP will produce between twenty-five and fifty pounds of fresh, organic leafy greens each month. Extension will donate 100% of this produce to the food pantry at Hawthorne Community Center (letter attached), providing between 3300-6600 servings of leafy greens annually to Marion County residents in need. Engagement and educational activities promoting the benefits of hydroponics will become an integral part of the Extension urban agriculture programming in Marion County through this program. The funding from ISDA for three years of programming will be leveraged to include an additional two years of programming within The AMP (support letter attached), with a long-term strategy to incorporate programming in additional heavily trafficked public areas, k-12 schools, community events and festivals.

Literature Cited

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[13] K. A. Williams, O. Francescangeli, J. Nelson. Using Organic Fertilizers in Hydroponics and Recirculating Culture. Greenhouse Product News. September, 2013
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PROVIDE A LISTING OF THE OBJECTIVES THAT THIS PROJECT HOPES TO ACHIEVE

Add more objectives by copying and pasting the existing listing or delete objectives that aren't necessary.

Objective 1: Develop two technologies to continuously and non-destructively monitor and maintain plant N status at an optimal level in hydroponically grown organic lettuce production. Enable the technologies to become available to hydroponic growers

Objective 2: Conduct extension workshops at Purdue University to train Indiana hydroponic growers with the developed technology

Objective 3: Showcase the developed technology at 16 Tech Innovation District (Indianapolis) to educate the community on nutritional benefits of leafy greens, with a focus on under-resourced residents facing food insecurity.

PROJECT BENEFICIARIES

Estimate the number of project beneficiaries: 600

Does this project directly benefit socially disadvantaged farmers as defined in the RFA? **Yes** ☑ **No** ☐

Does this project directly benefit beginning farmers as defined in the RFA? **Yes** ☑ **No** ☐

STATEMENT OF ENHANCING SPECIALTY CROPS

By checking the box to the right, I confirm that this project enhances the competitiveness of specialty crops in accordance with and defined by the Farm Bill. Further information regarding the definition of a specialty crop can be found at www.ams.usda.gov/services/grants/scbgp. ☑

CONTINUATION PROJECT INFORMATION

Does this project continue the efforts of a previously funded SCBGP project? **Yes** ☐ **No** ☑

If you have selected "yes", please address the following:

DESCRIBE HOW THIS PROJECT WILL DIFFER FROM AND BUILD ON THE PREVIOUS EFFORTS

N/A

PROVIDE A SUMMARY (3 TO 5 SENTENCES) OF THE OUTCOMES OF THE PREVIOUS EFFORTS

N/A

PROVIDE LESSONS LEARNED ON POTENTIAL PROJECT IMPROVEMENTS

What was previously learned from implementing this project, including potential improvements?

N/A

How are the lessons learned and improvements being incorporated into the project to make the ongoing project more effective and successful at meeting goals and outcomes?

N/A

DESCRIBE THE LIKELIHOOD OF THE PROJECT BECOMING SELF-SUSTAINING AND NOT INDEFINITELY DEPENDENT ON GRANT FUNDS

The technologies developed by the project will be licensed to growers on an annual basis to result in income that supports extension programs in the future. We will actively pursue grants from federal agencies and industry to support long-term research and engagement activities both at Purdue and 16 Tech Innovation District.

We plan to collaborate with industry partners involved in organic hydroponics industry in Indiana. The industry collaborators will provide in-kind support to future research by providing greenhouse space, plant materials, and their time for collecting data.

In addition, Department of Horticulture and Landscape Architecture at Purdue University will provide greenhouse space and experimental materials to PI.

OTHER SUPPORT FROM FEDERAL OR STATE GRANT PROGRAMS

The SCBGP will not fund duplicative projects. Did you submit this project to a Federal or State grant program other than the SCBGP for funding and/or is a Federal or State grant program other than the SCBGP funding the project currently?

Yes ☐ **No** ☑

IF YOUR PROJECT IS RECEIVING OR WILL POTENTIALLY RECEIVE FUNDS FROM ANOTHER FEDERAL OR STATE GRANT PROGRAM

Identify the Federal or State grant program(s).

N/A

Describe how the SCBGP project differs from or supplements the other grant program(s) efforts.

N/A

EXTERNAL PROJECT SUPPORT

Describe the specialty crop stakeholders who support this project and why (other than the applicant and organizations involved in the project).

Greenhouse hydroponic growers, startup companies, county educators, mainstream consumers of organic produce, Tech 16 Innovation District collaborators, hundreds of visitors from the neighboring communities of Tech 16 Innovation District, local schools in Indiana, low-income housing groups, community members in food deserts, and other greenhouse professionals. Support letters from interested stakeholders are added to the application.

Hydroponic growers and startup companies will be extremely supportive of the project given that the research will address the major issue of crop productivity in organic hydroponics industry. The technology being developed is affordable to small, medium, and large-scale operations in Indiana. It will optimize nitrogen use and improve yield and yield stability in organic hydroponic production.

County educators will be interested to get trained in the technology to support clients in their respective regions

Mainstream consumers of organic produce will be interested as the technology aims to reduce the premium price of organically grown produce and enable healthy organic produce affordable to all consumers

Tech 16 Innovation District collaborators, hundreds of visitors from the neighboring communities, local schools in Indiana, low-income housing groups, and community members in food deserts will be interested in educational sessions on nutritional foods, home hydroponics, and available resources to establish small scale production units to support demand for fresh and healthy foods in their community

Many greenhouse professions involved in supplies to organic hydroponic industry will be interested as ithe project increases their sales

EXPECTED MEASURABLE OUTCOMES

SELECT THE APPROPRIATE OUTCOME(S) AND INDICATOR(S)/SUB-INDICATOR(S)

You must choose at least one of the eight outcomes listed in the SCBGP Performance Measures, which were approved by the Office of Management and Budget (OMB) to evaluate the performance of the SCBGP on a national level.

OUTCOME MEASURE(S)

Select the outcome measure(s) that are applicable for this project from the listing below.

- ☐**Outcome 1**: Enhance the competitiveness of specialty crops through increased sales (required for marketing projects)
- ☑**Outcome 2**: Enhance the competitiveness of specialty crops through increased consumption
- ☐**Outcome 3**: Enhance the competitiveness of specialty crops through increased access
- ☑**Outcome 4**: Enhance the competitiveness of specialty crops though greater capacity of sustainable practices of specialty crop production resulting in increased yield, reduced inputs, increased efficiency, increased economic return, and/or conservation of resources
- ☐**Outcome 5**: Enhance the competitiveness of specialty crops through more sustainable, diverse, and resilient specialty crop systems
- ☐**Outcome 6**: Enhance the competitiveness of specialty crops through increasing the number of viable technologies to improve food safety
- ☐**Outcome 7**: Enhance the competitiveness of specialty crops through increased understanding of the ecology of threats to food safety from microbial and chemical sources
- ☐**Outcome 8**: Enhance the competitiveness of specialty crops through enhancing or improving the economy as a result of specialty crop development

OUTCOME INDICATOR(S)

Provide at least one indicator listed in the SCBGP Performance Measures and the related quantifiable result. If you have multiple outcomes and/or indicators, repeat this for each outcome/indicator.

FOR EXAMPLE:

Outcome 2, Indicator 1.a.

Of the 150 total number of children and youth reached, 132 will gain knowledge about eating more specialty crops.

Outcome 2, Indicator 1
Of the 300 children and youth reached: 270 will gain knowledge about eating more specialty crops, 240 reported an intention to eat more specialty crops, 150 reported eating more specialty crops.

Outcome 2, Indicator 2
Of the 1000 children and youth reached: 900 will gain knowledge about eating more specialty crops, 500 reported an intention to eat more specialty crops, 250 reported eating more specialty crops.

Outcome 4, Indicator 2. A, b, c
Adoption of best practices and technologies resulting in increased yields, reduced inputs, increased efficiency, increased economic return, and conservation of resources.
100 growers/producers indicating adoption of recommended practices.
100 growers/producers reporting reduction in pesticides, fertilizer, water used/acre.
50 producers reporting increased dollar returns per acre or reduced costs per acre.

MISCELLANEOUS OUTCOME MEASURE

In the unlikely event that the outcomes and indicators above the selected outcomes are not relevant to your project, you must develop a project-specific outcome(s) and indicator(s) which will be subject to approval by AMS.

DATA COLLECTION TO REPORT ON OUTCOMES AND INDICATORS

Explain how you will collect the required data to report on the outcome and indicator in the space below.

Outcome 2
We will develop a computer-based survey (short questionnaire, 2-3 minutes for completion) for visitors to our display at 16 Tech Innovation District. The questions will be related to knowledge gain and intention to consume specialty crops based on the learning and demonstration at 16 Tech. We will also collect the contact information of survey participants and contact them after several weeks (6 to 12 months) and conduct a paper-based survey to identify how many of participants have actually increased their consumption of specialty crops, to measure the impact.
The PI, Co-PI, graduate student, extension educator, and contractual employee will oversee activities at 16 Tech Innovation District. We plan to develop a computer-based interactive and self-guided tour of the display at Tech 16 Innovation District (5-7 minutes). We will also provide printed educational materials to visitors. The impact of this work will be published as bulletins and expert reviewed extension publications that can be downloaded free-of-cost on Purdue Extension Education Store.

Outcome 4
We will conduct surveys after workshops at Purdue to measure the data for above outcomes and indicators. The surveys will be conducted in the years 1, 2, and 3 of the project. The surveys will be paper-based and conducted onsite after workshops. We will reach to participants from years 1 and 2 during years 2 and 3. We will send paper-based surveys to participants. The data collected will include the number of growers who adopted new technology, observed reduction in organic nitrogen liquid fertilizer-use and increase in yield, and reported increased income from the workshop training.
The PI, Co-PI, graduate student, and extension educator will oversee workshop activities at Purdue. We will organize hydroponics workshops at Purdue and train attendees with research-based information on new technology and best practices for producing organically grown crops using hydroponics. We will also provide printed educational materials to participants. The results from this work will be published in expert reviewed extension publications that can downloaded free of cost on Purdue Extension Education Store, and develop educational materials that will be presented at future grower workshops and meetings.

BUDGET NARRATIVE

All expenses described in this Budget Narrative must be associated with expenses that will be covered by the SCBGP. If any matching funds will be used and a description of their use is required by the State department of agriculture, the expenses to be covered with

matching funds must be described separately. Applicants should review the Request for Applications section 4.7 Funding Restrictions prior to developing their budget narrative.

Budget Summary	
Expense Category	**Funds Requested**
Personnel	$79,195.00
Fringe Benefits	$8,075.00
Travel	$1,774.56
Equipment	$0.00
Supplies	$16,900.00
Contractual	$7,800.00
Other	$25,470.00
Direct Costs Subtotal	$139,214.56
Indirect Costs	$4,176.44

Total Budget	$143,391.00

PERSONNEL

List the organization's employees whose time and effort can be specifically identified and easily and accurately traced to project activities that enhance the competitiveness of specialty crops. See the Request for Applications section 4.7.2 Allowable and Unallowable Costs and Activities, Salaries and Wages, and Presenting Direct and Indirect Costs Consistently under section 4.7.1 for further guidance.

#	Name/Title	Level of Effort (# of hours OR % FTE)	Funds Requested
1	Brooke Alford, Professional Assistant (Extension Educator)	3%	$5,713.00
2	Graduate Student Assistantship	50%	$73,482.00
3			
4			

Personnel Subtotal	

PERSONNEL JUSTIFICATION

For each individual listed in the above table, describe the activities to be completed by name/title including approximately when activities will occur. Add more personnel by copying and pasting the existing listing or deleting personnel that aren't necessary.

Personnel 1: Brooke Alford will dedicate 3% of her time as the local project lead for The AMP Hydroponics Interactive Display program. She will coordinate community educational opportunities and food donation program within the space and ensure program quality.

Personnel 2: A graduate student will be hired to conduct research and engagement activities. The salary (or assistantship) for graduate student is for 36 months. The student will be responsible for conducting research and workshops at Purdue by working

FRINGE BENEFITS

Provide the fringe benefit rates for each of the project's salaried employees described in the Personnel section that will be paid with SCBGP funds.

#	Name/Title	Fringe Benefit Rate	Funds Requested
1	Brooke Alford, Professional Assistant (Extension Educator)	33%	$1,888.00
2	Graduate Student Assistantship	8%	$6,187.00

#	Name/Title	Fringe Benefit Rate	Funds Requested
3			
4			

Fringe Subtotal	$8,075.00

TRAVEL

Explain the purpose for each Trip Request. Please note that travel costs are limited to those allowed by formal organizational policy; in the case of air travel, project participants must use the lowest reasonable commercial airfares. For recipient organizations that have no formal travel policy and for-profit recipients, allowable travel costs may not exceed those established by the Federal Travel Regulation, issued by GSA, including the maximum per diem and subsistence rates prescribed in those regulations. This information is available at http://www.gsa.gov. See the Request for Applications section 4.7.2 Allowable and Unallowable Costs and Activities, Travel, and Foreign Travel for further guidance.

#	Trip Destination	Type of Expense (airfare, car rental, hotel, meals, mileage, etc.)	Unit of Measure (days, nights, miles)	# of Units	Cost per Unit	# of Travelers Claiming the Expense	Funds Requested
1	AMP at Tech 16 Innovation District	Mileage	Days	528	$0.52	1	$274.56
2	K-12 Bus Rental to AMP at Tech 16 Innovation District	Mileage	Days	6	$250.00	1	$1,500.00
3							
4							
5							
6							
7							

Travel Subtotal	$1,774.56

TRAVEL JUSTIFICATION

For each trip listed in the above table describe the purpose of this trip and how it will achieve the objectives and outcomes of the project. Be sure to include approximately when the trip will occur. Add more trips by copying and pasting the existing listing or delete trips that aren't necessary.

Trip 1 (Approximate Date of Travel MM/YYYY): As project manager, it is estimated that Brooke Alford will make 33 trips to The AMP over the course of 3 years to observe, coordinate and educate utilizing the hydroponics interactive display.

Trip 2(Approximate Date of Travel MM/YYYY): Working alongside partners at Matchbox Learning, two trips of school children will visit the space twice annually to learn about hydroponic growing, nutrition of leafy greens and organic produce, basic cooking instructions, and the environment (letter att

CONFORMING WITH YOUR TRAVEL POLICY

By checking the box to the right, I confirm that my organization's established travel policies will be adhered to when completing the above-mentioned trips in accordance with 2 CFR 200.474 or 48 CFR subpart 31.2 as applicable. ☑

EQUIPMENT

Describe any special purpose equipment to be purchased or rented under the grant. "Special purpose equipment" is tangible, nonexpendable, personal property having a useful life of more than one year and an acquisition cost that equals or exceeds $5,000 per unit and is used only for research, medical, scientific, or other technical activities. See the Request for Applications section 4.7.2 Allowable and Unallowable Costs and Activities, Equipment - Special Purpose for further guidance

Rental of "general purpose equipment" must also be described in this section. Purchase of general purpose equipment is not allowable under this grant. See Request for Applications section 4.7.2 Allowable and Unallowable Costs and Activities, Equipment - General Purpose for definition, and Rental or Lease Costs of Buildings, Vehicles, Land and Equipment.

#	Item Description	Rental or Purchase	Acquire When?	Funds Requested
1				
2				
3				
4				

Equipment Subtotal	$0.00

EQUIPMENT JUSTIFICATION

For each Equipment item listed in the above table describe how this equipment will be used to achieve the objectives and outcomes of the project. Add more equipment by copying and pasting the existing listing or delete equipment that isn't necessary.

Equipment 1:

Equipment 2:

Equipment 3:

SUPPLIES

List the materials, supplies, and fabricated parts costing less than $5,000 per unit and describe how they will support the purpose and goal of the proposal and enhance the competitiveness of specialty crops. See Request for Applications section 4.7.2 Allowable and Unallowable Costs and Activities, Supplies and Materials, Including Costs of Computing Devices for further information.

Item Description	Per-Unit Cost	# of Units/Pieces Purchased	Acquire When?	Funds Requested
Organic Substrate	$60.00	16	3/2022	$960.00
Substrate incorporated organic fertilizer	$40.00	8	3/2022	$320.00
Water soluble organic fertilizer	$700.00	1	3/2022	$700.00
pH buffer	$50.00	2	3/2022	$100.00
Organic seeds	$200.00	2	3/2022	$400.00
Pots (960/pack)	$250.00	1	3/2022	$250.00
Drip irrigation system	$1,500.00	1	3/2022	$1,500.00
Micro-fertigation system	$400.00	2	3/2022	$800.00
Tissue Analyses	$20.00	64	12/2022	$1,280.00
Printed Leaflets	$0.50	900	12/2022	$450.00
Dataloggers- Sensors- Camera system	$2,500.00	1	3/2022	$2,500.00
Interactive Display Monitors	$671.00	2	3/2022	$1,342.00
Vertical Hydroponics System	$1,600.00	1	1/2022	$1,600.00
Horizontal Hydroponics System	$3,000.00	1	1/2022	$3,000.00

Item Description	Per-Unit Cost	# of Units/Pieces Purchased	Acquire When?	Funds Requested
Computers	$849.00	2	1/2022	$1,698.00

Supplies Subtotal	$16,900.00

SUPPLIES JUSTIFICATION

Describe the purpose of each supply listed in the table above purchased and how it is necessary for the completion of the project's objective(s) and outcome(s).

Organic Substrate: Organic substrate is used for growing plants during research at Purdue

Substrate incorporated organic fertilizer: The items will be used in research at Purdue

Water soluble organic fertilizer: The item will be used in research at Purdue

pH buffer: The item will be used to manage pH during experiments at Purdue University

Organic seeds: Seeds will be used for experimental research at Purdue

Pots (960/pack): The items will be used for holding organic media and growing plants during experimentation at Purdue University

Drip irrigation system: The drip irrigation system will be used for research activities at Purdue University

Micro-fertigation system: The system will be used for supplying dosed quantity of water soluble organic fertilizer to plants in research

Tissue Analyses: The sample testing is needed for research at Purdue University. This will enable differentiate two treatments,

Printed Leaflets: The materials will be used for educational purposes during worshops and Tech 16 Innovation District

Dataloggers- Sensors- Camera system: The system will be integrated with interactive display for educational purposes. The components include datalogger ($500), battery supply ($350), tripod ($150), nutrient sensors ($500), temperature sensors ($300), light sensors ($500), camera ($200)

Interactive Display Monitors: Monitors will be used to display interactive educational sessions at Tech 16 Innovation District

Vertical Hydroponics System: The system will be used to display hydroponics production at Tech 16 Innovation District. The components include two ZipGrow vertical Wall systems each costing $800 (total $1600)

Horizontal Hydroponics System: This will be used to showcase hydroponic production at Tech 16 Innovation District. Components include chrome shelves ($150 x 2 = $300), LED lights ($150 x 16 = $2400), reservoirs, trays, pumps, plumbing ($300).

Computers: Computers will be used with interactive display monitors to display pre-developed educational software and conduct computer based surveys

CONTRACTUAL/CONSULTANT

Contractual/consultant costs are the expenses associated with purchasing goods and/or procuring services performed by an individual or organization other than the applicant in the form of a procurement relationship. If there is more than one contractor or consultant, each must be described separately. (Repeat this section for each contract/consultant.)

ITEMIZED CONTRACTOR(S)/CONSULTANT(S)

Provide a list of contractors/consultants, detailing out the name, hourly/flat rate, and overall cost of the services performed. Please note that any statutory limitations on indirect costs also apply to contractors and consultants.

#	Name/Organization	Hourly Rate/Flat Rate	Funds Requested
1	Contractual	$25.00	$7,800.00
2			
3			
4			

Contractual/Consultant Subtotal	$7,800.00

CONTRACTUAL JUSTIFICATION

Provide for each of your real or anticipated contractors listed above a description of the project activities each will accomplish to meet the objectives and outcomes of the project. Each section should also include a justification for why contractual/consultant services are to be used to meet the anticipated outcomes and objectives. Include timelines for each activity. If contractor employee and consultant hourly rates of pay exceed the salary of a GS-15 step 10 Federal employee in your area, provide a justification for the expenses. This limit does not include fringe benefits, travel, indirect costs, or other expenses. See Request for Applications section 4.7.2 Allowable and Unallowable Costs and Activities, Contractual and Consultant Costs for acceptable justifications.

Contractor/Consultant 1: Working in partnership with industry partner, Super Micro Greens (support letter attached), a hydroponics contractor will visit the space for 2 hours weekly throughout the course of the project (3 years) to insure health of system and maximum yield.

Contractor/Consultant 2:

Contractor/Consultant 3:

Add other Contractors/Consultants as necessary

CONFORMING WITH YOUR PROCUREMENT STANDARDS

By checking the box to the right, I confirm that my organization followed the same policies and procedures used for procurements from non-federal sources, which reflect applicable State and local laws and regulations and conform to the Federal laws and standards identified in 2 CFR Part 200.317 through.326, as applicable. If the contractor(s)/consultant(s) are not already selected, my organization will follow the same requirements. ☑

OTHER

Include any expenses not covered in any of the previous budget categories. Be sure to break down costs into cost/unit. Expenses in this section include, but are not limited to, meetings and conferences, communications, rental expenses, advertisements, publication costs, and data collection.

If you budget meal costs for reasons other than meals associated with travel per diem, provide an adequate justification to support that these costs are not entertainment costs. See Request for Applications section 4.7.2 Allowable and Unallowable Costs and Activities, Meals for further guidance.

Item Description	Per-Unit Cost	Number of Units	Acquire When?	Funds Requested
Container Lease	$6,600.00	3	1/2022	$19,800.00
At-home grow kits	$31.50	180	3/2022	$5,670.00

Other Subtotal	$25,470.00

OTHER JUSTIFICATION

Describe the purpose of each item listed in the table above purchased and how it is necessary for the completion of the project's objective(s) and outcome(s).

Container Lease: The container is an enclosed growing space used for educational purposes and showcasing hydroponics at Tech 16 Innovation District. We will apply for multi-year federal grants using data from this project for sustained use of container beyond 3 years.

At-home grow kits: A total of 180 at complete home hydroponics kits will be given to low-income residents attending educational activities at the space.

INDIRECT COSTS

The indirect cost rate must not exceed 8 percent of any project's budget. Indirect costs are any costs that are incurred for common or joint objectives that therefore, cannot be readily identified with an individual project, program, or organizational activity. They generally include facilities operation and maintenance costs, depreciation, and administrative expenses. See Request for Applications section 4.7.1 Limit on Administrative Costs and Presenting Direct and Indirect Costs Consistently for further guidance.

Indirect Cost Rate	Funds Requested
3%	$4,176.44

Indirect Subtotal	$4,176.44

PROGRAM INCOME

Program income is gross income—earned by a recipient or subrecipient under a grant—directly generated by the grant-supported activity, or earned only because of the grant agreement during the grant period of performance. Program income includes, but is not limited to, income from fees for services performed; the sale of commodities or items fabricated under an award (this includes items sold at cost if the cost of producing the item was funded in whole or partially with grant funds); registration fees for conferences, etc.

Source/Nature of Program Income	Description of how you will reinvest the program income into the project to enhance the competitiveness of specialty crops	Estimated Income

Program Income Total	$0.00

Figures

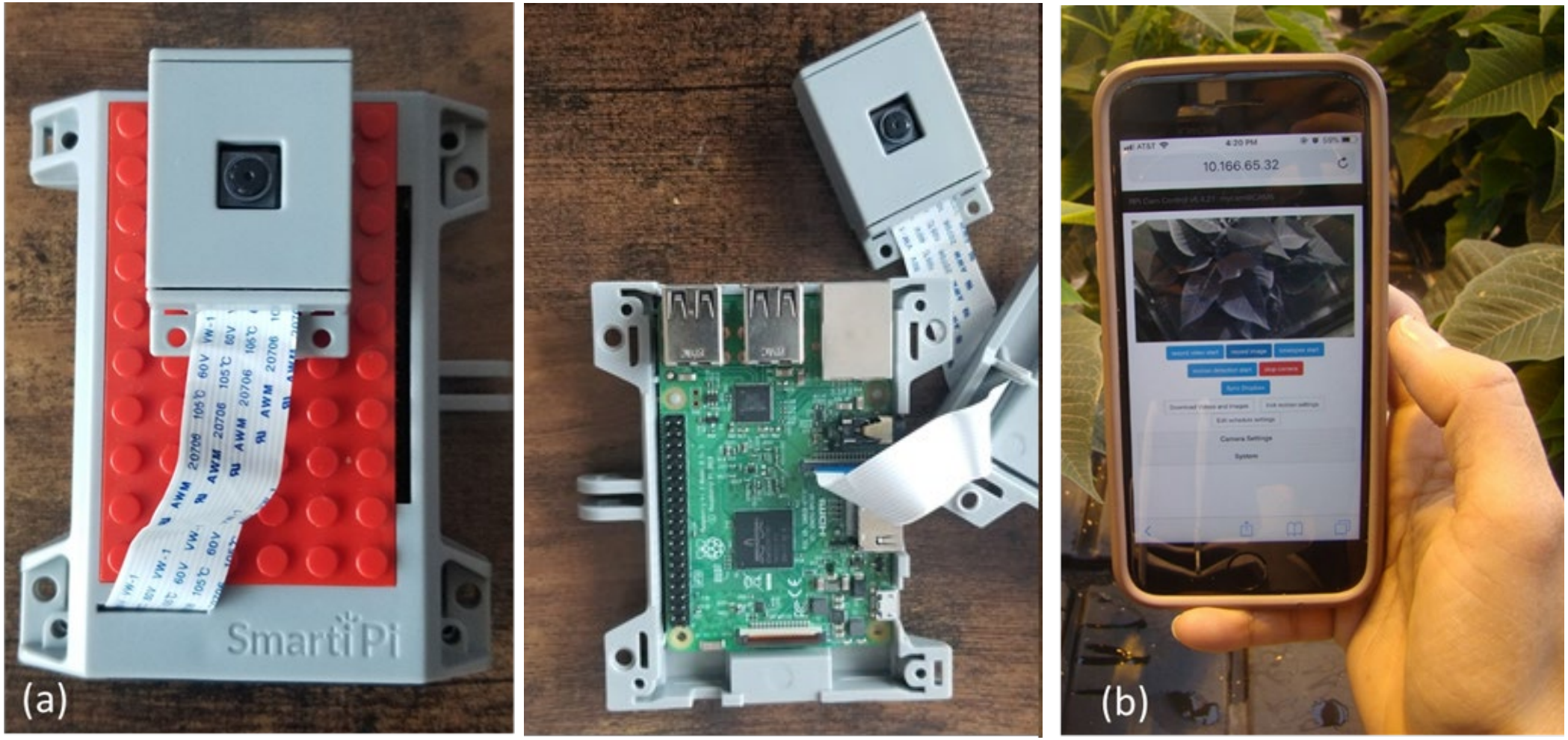


Figure 1. Affordable technologies for measuring crop growth and plant nitrogen status being developed by Principal Investigator at Purdue University. a. Microcontroller interfaced to a camera, b. smartphone-based sensing

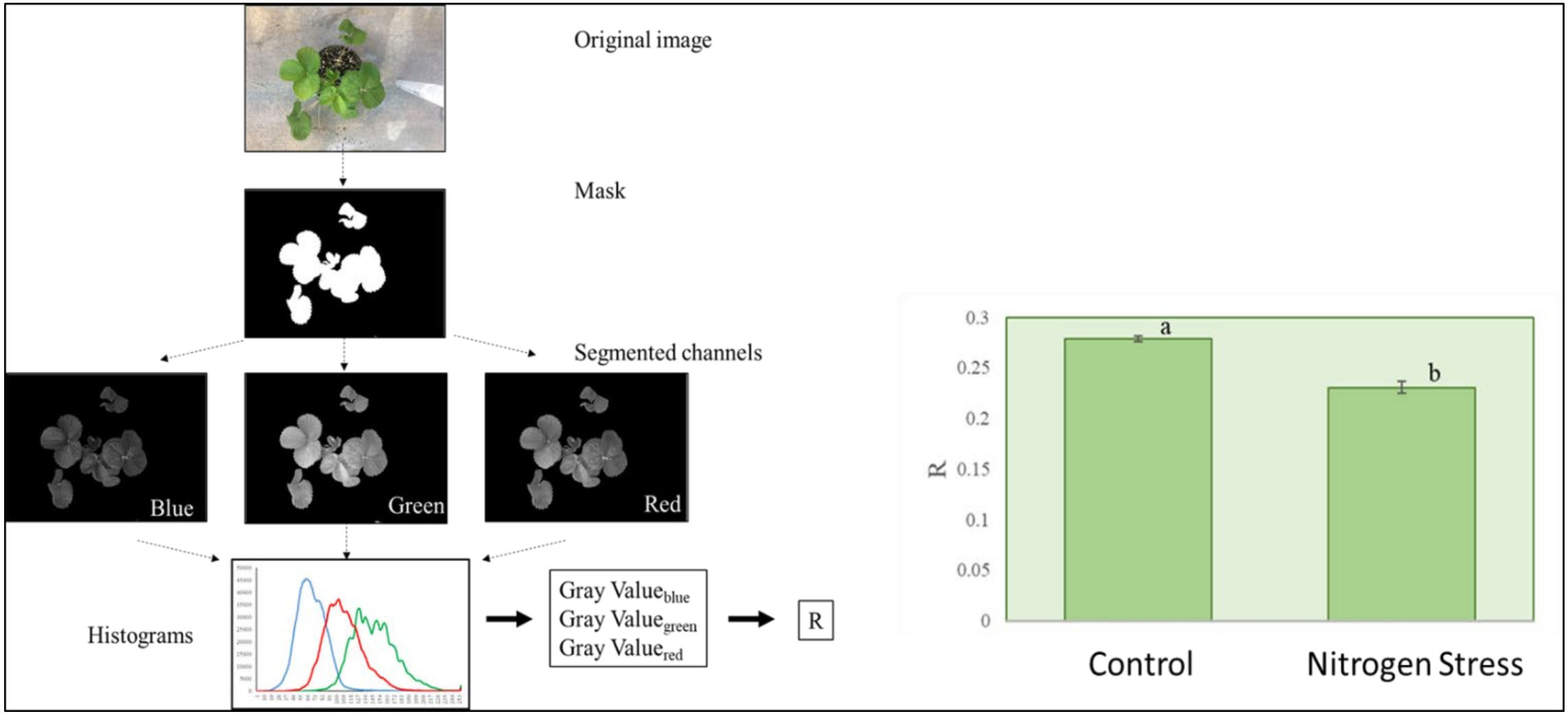
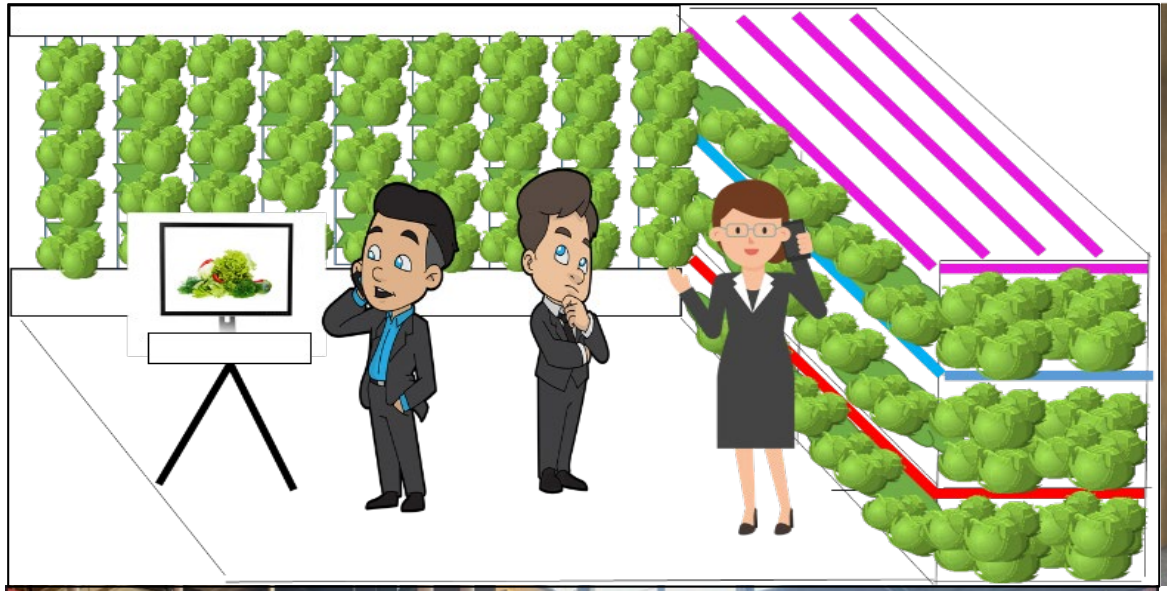


Figure 2. Illustration of smartphone based technology to measure an index for plant nitrogen status in strawberry. Principal Investigator at Purdue University developed the technique. The index (R-value) is lower under nitrogen stress conditions



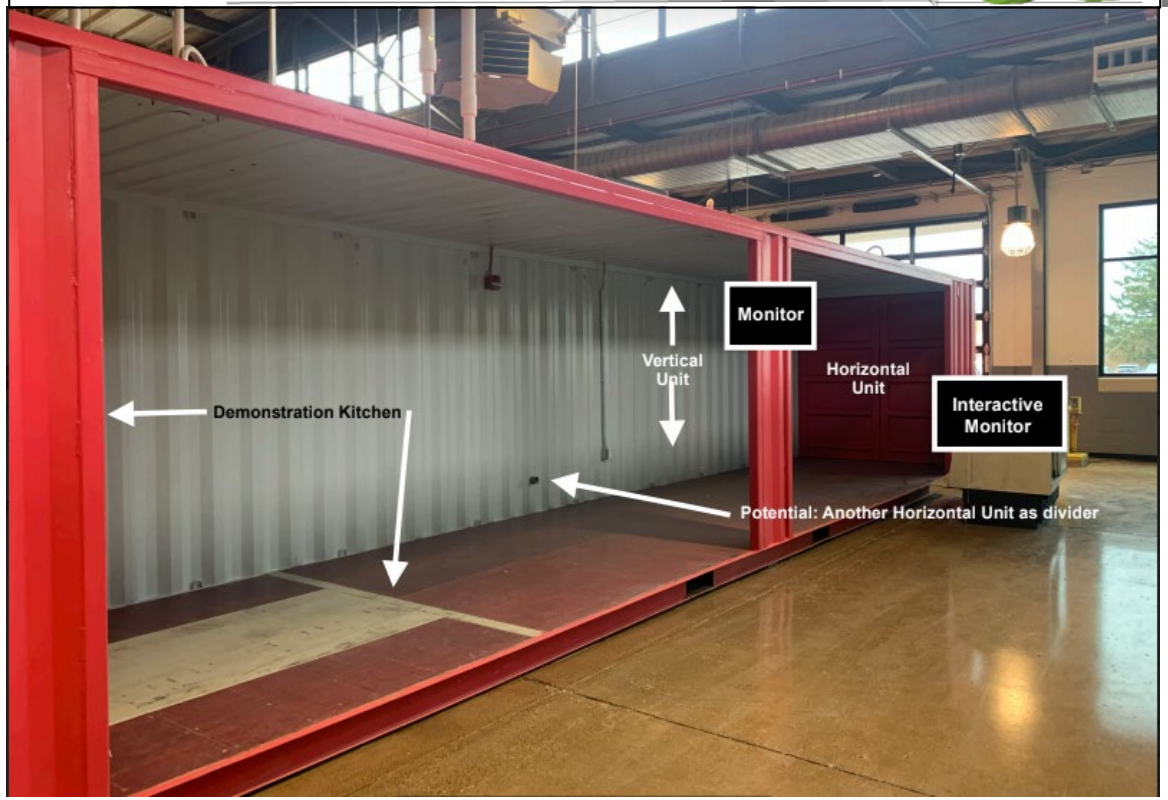


Figure 3. (top left) Proposed display of hydroponic technology at 16 Tech Innovation District in Indianapolis. (top right) view of Artisan Market Place inside the 16 Tech Innovation District, (bottom left) actual container that will be rented at Artisan Market Place.

Table of Contents

Krishna Nemali
Assistant Professor and Extension Specialist
Department of Horticulture and Landscape Architecture
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Website: www.purdue.edu/hla/sites/cea

BACKGROUND

Dr. Nemali joined the Department of Horticulture and Landscape Architecture at Purdue University in July 2016 as an Assistant Professor and Extension Specialist. At Purdue University, Dr. Nemali has responsibility for developing extension, research and teaching activities related to Controlled Environment Agriculture (CEA) and floriculture. He develops region-specific best production practices that maximize productivity, crop value, and food safety in CEA. Further, he trains CEA growers in Indiana and the Midwest with research-based information to increase their competitiveness and decision-making abilities. In addition to supporting CEA industry, Dr. Nemali is engaged in translating the benefits of CEA to the community. He establishes indoor CEA systems in schools to provide hands-on experience and formal education to schoolchildren on indoor vegetable production. The goal of his program is to increase the awareness and liking for healthy food choices (e.g. leafy greens) among schoolchildren. Dr. Nemali also leads the floriculture program at Purdue. He is focused on developing state-of-the-art and affordable 'smart sensors' (digital sensors) that can aid in improving quality and productivity of floriculture crops and filling the gap created by limited trained workforce in the industry. He transfers the smart technology to floriculture growers through extension programs.

GENERAL INFORMATION

A. Academic Degrees

- Ph.D. in Horticulture, University of Georgia, Athens, GA. December 2005
- M.S. in Horticulture, University of Georgia, Athens, GA. December 2002
- B.S. in Agriculture, Acharya N.G. Ranga Agriculture University, India, December 1992

B. Professional Experience

- July 2016 - Current: Assistant Professor and Extension Specialist, Purdue University
- October 2007- June 2016: Controlled Environment Crop Physiologist, Monsanto Company, U.S.A.
- January 2006 – June 2007: Post-Doctoral Fellow, University of California, Davis, CA
- January 2001- December 2005: Graduate Research Assistant, Horticulture Department, University of Georgia, Athens, GA
- October 1996 – October 2000: Horticulturalist, Ramoji Film City, AP, India

C. Awards and Honors

Purdue University:

- Scholarship of Engagement Fellow, Purdue University (2020)

- Purdue University Cooperative Extension Specialists Association (PUCESA) Early Career Award (2019)
- Seeding for Success Award (2019)

Monsanto Company:

- Technology Award (2015, 2014)
- Above and Beyond Award (2014)
- Regulatory Leadership Team Award (2014)
- Excellence Award for Identification of Area of Improvement in Safety (2010)
- Yield and Traits Program Awards (2008, 2009 and 2011)

D. Membership in Academic, Professional, and Scholarly Societies

- American Society for Horticultural Science, since 2001
- American Society of Plant Biologists, 2006-07

ENGAGEMENT

Extension Publications

(i). Expert Reviewed Extension Publications

Publications with graduate student names (underlined) in the list shown below. These publications can be accessed on Purdue Extension Education Store (link).

1. Nemali, K. (2021). Temperature Control in Greenhouses. (HO-327-W).
2. Adhikari, R. and Nemali, K. (2020). Substrate versus Fertilizer-based Electrical Conductivity Measurements (HO-322-W).
3. Nemali, K. (2020). Plant Monitoring Using Smartphones in Protected Agriculture (HO-318-W).
4. Adhikari, R. and Nemali, K. (2020). Optimal Fertilizer Concentration for Early vs. Late Flowering Petunia Varieties (HO-313-W).
5. Nemali, K. (2020). Slowing Growth of Ornamentals for Holding Plants in Greenhouses (HO-314-W).
6. Miller, A. G., Langenhoven, P., and Nemali, K. (2020). Optimal fertilizer solution concentration for hydroponic lettuce production (HO-311-W)
7. Miller, A. G., Langenhoven, P., and Nemali, K. (2020). Performance of Lettuce Varieties in Greenhouse Hydroponic Production (HO-309-W)
8. Miller, A. G., Langenhoven, P., & Nemali, K. (2020). Performance of Lettuce Varieties under Cold Temperature Conditions in Greenhouse Hydroponic Production (HO-310-W)
9. Miller, A. and K. Nemali. 2019. Heating Requirements for Winter Hydroponic Lettuce Production (HO-308-W).
10. Nemali, K. 2018. Understanding the Pores of a Soilless Substrate (HO-287-W).
11. Nemali, K. 2018. A Detail of Electrical Conductivity Measurements in Greenhouse Production (HO-286-W).
12. Nemali, K. 2018. Pour-through Technique of Measuring Electrical Conductivity of the Substrate (HO-285-W).

13. Nemali, K. 2018. Starter Fertilizer Can Provide Substantial Amount of Nutrients in Sub-irrigation (HO-284-W).
14. Nemali, K. and P. Langenhoven. 2018. Determining the Economic Value of Providing Supplemental Light to Lettuce during Winter Production (HO-283-W).
15. Nemali, K. 2018. Normalized Difference Vegetation Index (NDVI): A Promising Method to Detect Crop Light Use in Greenhouses (HO-282-W).

Table 1. Metrics on extension publications on Purdue Education Store

Period	Number of Publications	Number of Downloads	Avg. Downloads per publication	Range
Jan, 2018 to Dec 2020	14	12620	902	67 to 5052

(ii). Articles in Industry Magazines

Following is a list of articles of Dr. Nemali and his graduate students published in popular industry magazines:

1. R. Adhikari, C. Li, and K. Nemali. 2019. Sensing the N. GrowerTalks.
2. K. Nemali. 2019. Phone Home. Greenhouse Management.
3. K. Nemali. 2019. Monitor Plant Quality with Next Generation Sensors. Greenhouse Management.
4. R. Adhikari, C. Li, K. Kalbaugh, and K. Nemali. 2019. A low-cost sensor connected to smartphone/computer for measuring plant nitrogen content. American Floral Endowment Newsletter.
5. J. Craver, K. Nemali, and R. Lopez. 2019. Monitoring growth of bedding plant seedlings using images. Greenhouse Management.
6. K. Nemali. 2019. Monitor Plant quality with next generation sensors. Nursery Management
7. K. Nemali, R. Adhikari, C. Li, and K. Kalbaugh. 2020. Smart sensor for measuring plant nitrogen status of floriculture crops. American Floral Endowment newsletter.

Technology Transfer Tools

(i) Website Development

Dr. Nemali manages CEA website (www.purdue.edu/hla/sites/cea) specifically developed for growers, extension educators, and students to learn about his extension and applied research programs. Since its inception in January 2018, Dr. Nemali's website had 16,266 sessions, 12,791 users, and 34,876 page views with 77% of them viewed by new visitors (source: Google Analytics; Feb 28, 2021).

(ii) Social Media

Dr. Nemali hosts separate Facebook pages for Indiana Flower Growers Association and Indiana Hydroponic Growers Alliance. There are 274 members on both Facebook pages. There has been an increase of 35% in membership and more than 2000 active posts in the last 12 months.

Extension Presentations

(i) Invited Extension Presentations

Table 2. List of invited Extension presentations since 2016

Month, Year	Sponsor	Title	Topic	Attendees
Dec, 2016	University of Kentucky-Extension	Speaker	Temperature effects on growth of floriculture crops	60
Jan, 2017	Iliana Conference/ Schererville, IN	Speaker	Greenhouse transplant production	70
Mar, 2017	Indiana Small Farms Conference/Danville, IN	Speaker	Smartphone apps for sensing irrigation needs	15
Jan, 2019	Illinois Specialty Crop Conference, Springfield, IL	Speaker	Greenhouse and indoor hydroponics	24
Feb, 2020	Women in Ag conference, Muncie, IN	Speaker	Home hydroponics	32
Aug, 2020	University of Missouri Extension, Springfield	Speaker	In-service training on Hydroponics	postponed (COVID)
Oct, 2020	Booker T. Washington High School, Houston, TX	Speaker	Floriculture in the US	14
Nov, 2020	The Tippecanoe Senior Center, Lafayette, IN	Speaker	Growing leafy greens at home	8
Feb, 2021	University of New Hampshire, Extension	Speaker	Indoor farming for beginner farmers	24
Mar, 2021	Gary Urban Farming Initiative	Speaker	Hydroponics 101	16
Jul, 2021	Cultivate' 21	Speaker	HRI, thrive series	TBD

(ii). Other Extension Presentations

Table 3. List of other Extension presentations since 2016

Date	Conference/Location	Role	Topic	Attendees
Oct, 2016	Annual Conference of Indiana Flower Growers Association, Purdue	Chair/ Speaker	Multiple/ Business related	41
Jan, 2017	Indiana Horticulture Congress, Indianapolis	Session Chair	Supplemental lighting in greenhouses, Forms of N fertilizer	15
Mar, 2017	Hydroponic Workshop, Purdue University	Chair/ Speaker	Nutrition, lighting and temperature requirements of hydroponic crops	41
Sep, 2017	Hydroponic Workshop/Purdue University	Chair/ Speaker	Supplemental lighting in greenhouses	66
Oct, 2017	Annual Conference of Indiana Flower Growers Association, Purdue University	Chair	Multiple/ Business related	28
Feb, 2018	Indiana Horticulture Congress/ Indianapolis	Chair/ Speaker	Lighting and plant nutrition	34
Sep, 2018				73

	Hydroponic Workshop/Purdue University	Chair/ Speaker	Heating, Nutrition, Biological Control, Marketing, Disease Management and Food Safety; hands-	
Oct, 2018	Annual Conference of Indiana Flower Growers Association, Purdue University	Chair/ Speaker	Multiple/ Business related	25
Feb, 2019	Indiana Horticulture Congress/ Indianapolis	Speaker	Heating requirement for greenhouses; Vertical farming	33
Sep, 2019	Hydroponic Workshop/Purdue University	Speaker	Identifying nutrient deficiencies, measuring light intensity using sensors, calibrate electrical conductivity sensors, demonstration on building an indoor production facility, and growth under different hydroponics substrates	85
Oct, 2019	Annual Conference of Indiana Flower Growers Association, Purdue University	Speaker	Smartphone for monitoring germination, height and compactness; Low-cost N sensor/ automated container irrigation; Experience EC/pH sensors; Light spectrum effects on bedding plants	25

Table 4. Extension webinars on 'Greenhouse and Indoor Production of Specialty Crops'

Month, Year	Topic (Presenter)	Participants
Jun, 2020	Greenhouse Construction (Nemali)	28
Jul, 2020	Heating and Cooling in Greenhouses (Nemali)	31
Aug, 2020	Integrating Biopesticides into Pest Management Programs (Ingwell)	35
Sep, 2020	Identifying Nutrient Deficiencies in Greenhouse and Indoor Crops (Nemali)	34
Oct, 2020	Hydroponics 101 (Nemali)	65
Nov, 2020	Indoor (Vertical) Farming (Nemali)	32
Feb, 2021	Greenhouse Strawberry Production (Kubota, The Ohio State University)	34

DISCOVERY

Scientific Publications

(i). Publications after joining Purdue (graduate student names are underlined)

1. Kong, Y. and K. Nemali. (2020). Blue and Far-red Light Affect Number and Area of Individual Leaves to Influence Vegetative Growth and Pigment Synthesis in Lettuce. Frontiers in Plant Science (submitted).

2. Burgner, S., Nemali, K., Massa, G., Wheeler, R., Morrow, R., & Mitchell, C. A. (2020). Growth and photosynthetic responses of Chinese cabbage (*Brassica rapa* L. cv. Tokyo Bekana) to continuously elevated carbon dioxide in a simulated Space Station "Veggie" crop-production environment. Life Sciences in Space Research. Published. https://doi.org/https://doi.org/10.1016/j.lssr.2020.07.007
3. Miller, A., Adhikari, R., & Nemali, K. (2020). Recycling nutrient solution can reduce growth due to nutrient deficiencies in hydroponic production. Frontiers in Plant Science. https://doi.org/https://doi.org/10.3389/fpls.2020.607643
4. Adhikari, R., & Nemali, K. (2020). A Novel Method for Estimating Nitrogen Stress in Plants Using Smartphones. Horticulturae (MDPI Journal), 6(4), 76. https://doi.org/https://doi.org/10.3390/horticulturae6040074
5. Miller, A., Langenhoven, P., & Nemali, K. (2020). Maximizing Productivity of Greenhouse-grown Hydroponic Lettuce during Winter. HortScience, 55(12). https://doi.org/https://doi.org/10.21273/HORTSCI15351-20
6. Adhikari, R., Li, C., Kalbaugh, K., & Nemali, K. (2020). A low-cost smartphone controlled sensor based on image analysis for estimating whole-plant tissue nitrogen (N) content in floriculture crops. https://doi.org/https://doi.org/10.1016/j.compag.2019.105173
7. Fischer, J., Nemali, K., & Rogan, G. (2020). Yield component responses of biotechnology-derived drought tolerant maize under controlled environment conditions. Agricultural and Environmental Letters, 5(1). https://doi.org/https://doi.org/10.1002/ael2.20007
8. Craver, J., Nemali, K., & Lopez, R. (2020). Acclimation of growth and photosynthesis in petunia seedlings exposed to high intensity blue radiation. Journal of the American Society for Horticultural Science, 145(3). https://doi.org/https://doi.org/10.21273/JASHS04799-19
9. Li, C., Adhikari, R., Miller, A., Kalbaugh, K., & Nemali, K. (2020). Measuring Plant Growth Characteristics Using Smartphone Based Image Analysis Technique in Controlled Environment Agriculture. 2020. Computers and Electronics in Agriculture. https://doi.org/https://doi.org/10.1016/j.compag.2019.105123.
10. Nemali, K., & van Iersel, M. (2019). Relating Whole-plant Photosynthesis to Physiological Acclimations at Leaf and Cellular Scales under Drought Stress in Bedding Plants. Journal of the American Society for Horticultural Science. https://doi.org/https://doi.org/10.21273/JASHS04665-19.
11. Kong, Y., Nemali, A., Mitchell, C. A., & Nemali, K. (2019). Spectral Quality of Light Can Affect Energy Consumption and Energy-Use Efficiency of Electrical Lighting in Indoor Lettuce Farming. HortScience. https://doi.org/https://doi.org/10.21273/HORTSCI13834-18.

(ii). Publications prior to joining Purdue

1. K.S. Nemali, C. Bonin, F.G. Dohleman, M. Stephens, W.R. Reeves, D.E. Nelson, P. Castiglioni, J. E. Whitsel, B. Sammons, R.A. Silady, D. Anstrom, R. E. Sharp, O. R. Patharkar, D. Clay, M. Coffin, M. A. Nemeth, M. E. Leibman, M. Luethy & M. Lawson. 2015. Physiological Responses Related to Increased Grain Yield under Drought in the First Biotechnology-Derived Drought Tolerant Maize. Plant Cell & Environment 38 (9): 1866-80.
2. H.M. Easlon, K.S. Nemali, J.H. Richards et al. 2013. The physiological basis for genetic variation in water-use efficiency and carbon isotope composition in Arabidopsis thaliana. Photosynthesis Research 119 (1-2):119-29.

3. J.K. McKay, J.H. Richards, K.S. Nemali, S. Sen, T. Mitchell-olds, S. Boles, E.A. Stahl, T. Wayene, T.E. Juenger. 2008. Genetics of drought adaptation in Arabidopsis thaliana II: QTL analysis of new mapping population, Kas-1 x Tsu-1. Evolution 62 (12): 3014-3026.
4. K.S. Nemali and M.W. van Iersel. 2008. Physiological responses to different substrate water contents: screening for high water-use efficiency in bedding plants. J. Amer. Soc. Hort. Sci. 133: 1-8.
5. K.S. Nemali and M.W. van Iersel. 2007. A new controller for irrigation and simulating drought stress in potted plants. Scientia Horticulturae 110: 292-297.
6. K.S. Nemali, F. Montesano, S.K. Dove, and M.W. van Iersel. 2007. Calibration and Performance of moisture sensors in soilless substrates: ECH2O and Theta probes. Scientia Horticulturae. 112: 227-234.
7. van Iersel, M.W. and K.S. Nemali. 2004. Drought stress can produce small but not compact marigolds. HortScience 39: 1298-1301.
8. Kang, J-G., M.W. van Iersel, and K.S. Nemali. 2004. Fertilizer concentration and irrigation method affect growth and fruiting of ornamental pepper. J. Plant Nutr. 27: 867-884.
9. Nemali, K.S. and M.W. van Iersel. 2004. Acclimation of wax begonia to light intensity: changes in photosynthesis, respiration, and chlorophyll concentration. J. Amer. Soc. Hort. Sci. 129: 745-751.
10. Nemali, K.S. and M.W. van Iersel. 2004. Light effects on wax begonia: photosynthesis, growth respiration, maintenance respiration, and carbon use efficiency. J. Amer. Soc. Hort. Sci. 129: 416-424.
11. Nemali, K.S. and M.W. van Iersel. 2004. Light Intensity and fertilizer concentration: II. Optimal fertilizer solution concentration for species differing in light requirement and growth rate. HortScience 39:1293-1297.
12. Nemali, K.S. and M.W. van Iersel. 2004. Light Intensity and fertilizer concentration: I. estimating optimal fertilizer concentration from water-use efficiency of wax begonia. HortScience 39:1287-1292.
13. Nemali K.S. (Sainath-Krishna, M.N) and M.W. van Iersel. 2003. Light effects on wax begonia: photosynthesis, growth respiration, and maintenance respiration. Acta Hort. 624:541-547.

(iii). Book Chapters

1. K.S. Nemali and M. Stephens. 2014. Plant Abiotic Stress: Water. Encyclopedia of Agriculture and Food Systems, Elsiever Publishing Company 4: 335-43.
2. Nemali, K. and M.van Iersel.2004. Acclimation and growth of photosynthesis of wax begonias grown at different light levels. In: E. Runkle and P. Fischer (eds.) Lighting up profits. Understanding greenhouse lighting. p. 22-23. Meister publishing, Willoughby, Ohio. (ISBN 1-892829-10-X).

(iv). Accepted Conference Abstracts (student names are underlined)

1. Adhikari, R. and Nemali, K. 2020. A low-cost image based technique for measuring tissue nitrogen. Annual Conference of the American Society for Horticultural Science. Orlando, FL, United States.
2. Kong, Y. and Nemali, K 2020. Increasing productivity and phytochemical content in crops grown in vertical farms. Annual Conference of the American Society for Horticultural Science. Orlando, FL, United States.

3. Nemali, K. 2020. Lettuce Growth in Different Hydroponic Production Systems, Annual Conference of the American Society for Horticultural Science. Orlando, FL, United States.
4. Miller, A. G., Langenhoven, P., Nemali, K. 2020. Energy-Use-Efficiency Differences Between LED Supplemental Lights under Nutrient Film Technique (NFT) and Constant Flood Table (CFT) Systems, Indiana Horticultural Conference and Expo, Purdue Extension, Indianapolis, IN.
5. Miller. A, P. Langenhoven and K. Nemali. 2019. Nighttime Supplemental Lighting and Heated Hydroponic Solution Effects on the Growth of Different Lettuce Varieties in Nutrient Film and Deep Flow Techniques. HortScience.
6. Y. Kong and K. Nemali. 2019. Improving Energy Use Efficiency and Nutritive Quality of Lettuce in Indoor Production. HortScience.
7. Adhikari, R and K. Nemali. 2019. Physiological Bases for Differential Growth Responses to Supplied Nitrogen Concentration in Poinsettia Cultivars. HortScience.
8. Adhikari, R., C. Li and K. Nemali. 2019. Measuring Tissue Nitrogen (N) Content Using Smart Phones. HortScience.
9. Miller. A, P. Langenhoven and K. Nemali. 2019. Energy-Use-Efficiency Differences between Light Emitting Diode Based Supplemental Lights Under Nutrient Film and Deep Flow Techniques. HortScience.
10. Nemali, K. 2019. Modern Climate-Controlled Greenhouses. HortScience.
11. Miller, A and K. Nemali. 2018. Recycled Nutrient Solution Effects on Hydroponic Lettuce Growth in Deep Water Culture and Nutrient Film Technique. HortScience.
12. Miller, A and K. Nemali. 2018. Automated and Non-destructive Measurement of Plant Growth Characteristics using a Multispectral Image Based Technique in Controlled Environment Agriculture (CEA). HortScience.
13. R. Adhikari and K. Nemali. 2018. Estimating Tissue Nitrogen (N) Content in Floriculture Crops using Image Analysis. HortScience.
14. R. Adhikari and K. Nemali. 2018. .Image Analysis Technique for Remotely Estimating Light Absorption Efficiency in Plants Grown in Controlled Environment Agriculture (CEA). HortScience.
15. Kong, Y and K. Nemali. 2018. Comparison and basis of differences in energy use efficiency among different light emitting diode fixtures with varying light quality in indoor production. HortScience.
16. Kong, Y and K. Nemali. 2018. Development of a light controller for optimizing light use in plant factories. HortScience.
17. Nemali, K. 2017. Application of Remote Sensing to Monitor Plant Input Needs in Controlled Environment Agriculture. HortScience.
18. Nemali, K. 2017. Monitoring Supplemental Light Use of Petunia Using Normalized Difference Vegetation Index (NDVI) and Quantum Sensors HortScience.
19. Nemali, K. 2017. Managing Recycled Nutrient Solution for Maximum Growth of Hydroponic Lettuce. HortScience.
20. Nemali, K. 2017. Using Crop Reflectance Ratio to Optimize Nitrogen Concentration in the Nutrient Solution for Hydroponic Lettuce. HortScience.
21. Craver, J.C., K. Nemali and R. Lopez. 2017. Physiological acclimation of petunia seedlings to varying light intensity, light quality and CO2 concentrations in indoor production. HortScience.

22. Craver, J.C., K. Nemali and R. Lopez. 2017. Noninvasive imaging using fluorescence to measure growth of annual bedding plant seedlings. HortScience.
23. Nemali, K and M.W. van Iersel. 2016. Photosynthesis response of tomato plants subjected to drought treatments that differed in the rate but not level or duration of exposure to drought stress. HortScience.
24. Nemali, K. 2016. Improving production efficiency in controlled environment agriculture by utilizing remote sensing technologies. HortScience.
25. Nemali, K and M.W. van Iersel, 2016. Improving water and nutrient retention capacity of the pine bark substrate using amendments. HortScience.

Research Presentations

(i). Invited Presentations

1. Smart Sensors for Vertical Farming Industry. Department of Horticulture and Crop Science. **The Ohio State University**, Columbus, OH (May, 2021).
2. Smart Sensors in Controlled Environment Agriculture. Horticulture and Landscape Architecture Department. **Oklahoma State University**, Stillwater, OK (March, 2021).
3. Increasing Crop Value and Productivity in Vertical Farming. Department of Horticulture. **University of Arkansas**, Fayetteville, AK (2021)
4. Smart Sensors for Greenhouse Production. Horticulture Department. **G.B. Pant University of Agriculture and Technology, Pant Nagar, India** (2020).
5. Smart Sensors. Department of Horticulture and Landscape Architecture. **Colorado State University**, Fort Collins. CO (2020)
6. Optimizing energy use in vertical farming. Department of Horticulture Science, **Texas Agriculture & Mechanical University.** College Station, TX (2019)
7. Modern Climate-Controlled Greenhouses. **American Society for Horticultural Science Annual Conference**, Las Vegas, NV. (2019)
8. Next Generation Sensors. **Cultivate**, Columbus OH (2019).
9. Smartphone based Estimation of Plant Growth and Nitrogen Status. **American Society for Horticultural Science Annual Conference**, Washington DC. (2018)
10. Controlled Environment Agriculture. **Utsunomiya University, Tochigi, Japan** (2017)
11. Application of Remote Sensing to Monitor Plant Input Needs in Controlled Environment Agriculture. (Workshop Presentation). **American Society for Horticultural Science Annual Conference**, HI (2017).

(ii). Conference Presentations

1. Nemali, K., Adhikari, R. 2020. "A low-cost image based technique for measuring tissue nitrogen," Annual Conference of the American Society for Horticultural Science, Orlando, FL, United States.
2. Kong, Y. and Nemali, K. 2020. "Increasing productivity and phytochemical content in crops grown in vertical farms," Annual Conference of the American Society for Horticultural Science, Orlando, FL, United States. (August 2020).
3. Nemali, K. 2020. "Lettuce Growth in Different Hydroponic Production Systems," Annual Conference of the American Society for Horticultural Science,, Orlando, FL, United States. (August 2020).

4. Miller. A, P. Langenhoven and K. Nemali. 2019. Nighttime Supplemental Lighting and Heated Hydroponic Solution Effects on the Growth of Different Lettuce Varieties in Nutrient Film and Deep Flow Techniques. ASHS Annual Conference, Las Vegas, NV.
5. Y. Kong and K. Nemali. 2019. Improving Energy Use Efficiency and Nutritive Quality of Lettuce in Indoor Production. ASHS Annual Conference, Las Vegas, NV.
6. Adhikari, R and K. Nemali. 2019. Physiological Bases for Differential Growth Responses to Supplied Nitrogen Concentration in Poinsettia Cultivars. ASHS Annual Conference, Las Vegas, NV.
7. Adhikari, R, C. Li and K. Nemali. 2019. Measuring tissue nitrogen content using smartphones. Cultivate. Columbus OH.
8. Kong, Y and K. Nemali. 2018. Comparison and basis of differences in energy use efficiency among different light emitting diode fixtures with varying light quality in indoor production. ASHS Annual Conference, Washington, DC.
9. Nemali, K and A. Miller. 2017. Managing Recycled Nutrient Solution for Maximum Growth of Hydroponic Lettuce. ASHS Annual Conference, Waikoloa, HI.
10. Nemali, K and A. Miller. 2017. Using Crop Reflectance Ratio to Optimize Nitrogen Concentration in the Nutrient Solution for Hydroponic Lettuce. ASHS Annual Conference, Waikoloa, HI.
11. Nemali, K and M.W. van Iersel. 2016. Photosynthesis response of tomato plants subjected to drought treatments that differed in the rate but not level or duration of exposure to drought stress. ASHS Annual Conference, Atlanta, GA
12. Nemali, K. 2016. Improving production efficiency in controlled environment agriculture by utilizing remote sensing technologies. ASHS Annual Conference, Atlanta, GA.
13. Nemali, K and M.W. van Iersel, 2016. Improving water and nutrient retention capacity of the pine bark substrate using amendments. ASHS Annual Conference, Atlanta, GA.

External Grants

Dr. Nemali received a total of **$509,477** in external grants

1. Agency/Title of Grant: USDA/Developing technology and best practices for producing *Escherichia coli* (*E.coli*) free hydroponic lettuce, IN
2. Duration of Funding (Dates): 09/30/2019 to 09/29/2022
3. Total amount of award: $90,115.00
4. Your role: PI
5. If Co-PI, for how much of the total funding are you directly responsible: NA

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1. Agency/Title of Grant: Horticulture Research Institute/ Measurement of Plant Nitrogen Status in Floriculture and Nursery Production Using Smartphones
2. Duration of Funding (Dates): 03/01/2019 to 12/31/2020
3. Total amount of award: $48,000
4. Your role: PI
5. If Co-PI, for how much of the total funding are you directly responsible: NA

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1. Agency/Title of Grant: American Floral Endowment/ Smartphone-Based Rapid, Inexpensive, and Accurate Estimation of Plant Nitrogen Status in Floriculture
2. Duration of Funding (Dates): 08/20/2018 to 07/20/2020
3. Total amount of award: $33,000
4. Your role: PI
5. If Co-PI, for how much of the total funding are you directly responsible: NA

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1. Agency/Title of Grant: ISDA SCBG/ Research-Based Extension Education Program for Increased Year-Round-Profitability in Hydroponic Lettuce Production
2. Duration of Funding (Dates): 09/30/2017 to 09/30/2020
3. Total amount of award: $50,000
4. Your role: PI
5. If Co-PI, for how much of the total funding are you directly responsible: NA

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1. Agency/Title of Grant: ISDA SCBG/ Research-Based Education for Indiana Beginner Farmers on Profitable Indoor (Vertical) Farming
2. Duration of Funding (Dates): 09/30/2017 to 09/30/2020
3. Total amount of award: $35,000
4. Your role: PI
5. If Co-PI, for how much of the total funding are you directly responsible: NA

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1. Agency/Title of Grant: Multi-Sponsored/ Galema Greenhouse Inc.
2. Duration of Funding (Dates): 01/10/2018 to 12/31/2075
3. Total amount of award: $3,000
4. Your role: PI
5. If Co-PI, for how much of the total funding are you directly responsible: NA

---

1. Agency/Title of Grant: Fred Gloeckner Foundation/ Smartphone-Based Rapid, Inexpensive, and Accurate Estimation of Plant Nitrogen Status in Floriculture Production
2. Duration of Funding (Dates): 09/01/2017 to 08/31/2019
3. Total amount of award: $25,000
4. Your role: PI
5. If Co-PI, for how much of the total funding are you directly responsible: NA

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1. Agency/Title of Grant: USDA-FAS/ Plant Health/IPM for hydroponic vegetable crops
2. Duration of Funding (Dates): 08/15/2018 to 09/30/2020
3. Total amount of award: $46,660
4. Your role: PI
5. If Co-PI, for how much of the total funding are you directly responsible: NA

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1. Agency/Title of Grant: USDA-FAS/ Development of an affordable and efficient hydroponic or aeroponic crop production technology for Egypt and their adoption through extension

2. Duration of Funding (Dates): 08/012019 to 07/31/2021
3. Total amount of award: $49,830
4. Your role: PI
5. If Co-PI, for how much of the total funding are you directly responsible: NA

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1. Agency/Title of Grant: Purdue Graduate School/ Ross Fellowship or Assistantship
2. Duration of Funding (Dates): 01/01/2017 to 07/31/2020
3. Total amount of award: $28,872
4. Your role: PI
5. If Co-PI, for how much of the total funding are you directly responsible: NA

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1. Agency/Title of Grant: Purdue Office of Provost/ Advanced Hydroponic Production and Phenotyping for Horticulture Education
2. Duration of Funding (Dates): 01/01/2020 to 12/31/2020
3. Total amount of award: $100,000
4. Your role: PI
5. If Co-PI, for how much of the total funding are you directly responsible: NA

In addition, Dr. Nemali received several thousands of dollars in kind from industry. He received LED lights worth $3200 from Happy Leaf Corporation, IL, a $2000 in discount for research from Venttis, MI, and LED lights worth $4500 from Fluence BioScience, TX.

Mentoring

Table 5. List of graduate students mentored at Purdue

Name	Role	Degree	Completion Date
Past Students:			
Joshual Craver	Committee Member	PhD	2018
Samuel Burgner	Committee Member	MS	2018
David Flores	Committee Member	MS	2019
Alexander Miller	Major Advisor	MS	2019
Maria Roja Zea	Committee Member	MS	2020
Ranjeeta Adhikari	Major Advisor	PhD	April, 2021
Present Students:			
Yuyao Kong	Major Advisor	PhD	Dec, 2022
Fatemeh Sheibani	Committee Member	PhD	n.a.

Table 6. List of visiting students mentored at Purdue

Name	**Country**	**Degree**	**Training Period**
Yuyao Kong[1]	China Agricultural University, China	MS	2017-18
Reham Mohammed[2]	Plant Protection Research Institute, Egypt	Borlaug Fellow	2018
Chen Li[3]	China Agricultural University, China	MS	2018-19
Isabela Scavacini	Sao Pãulo University, Brazil	PhD	2021

[1] Y. Kong's work resulted in publication, [2] R. Mohammed collaborated further with Dr. Nemali which resulted in funding by USDA FAS to both Purdue and Plant Protection Research Institute; [3] C. Li's work resulted in publication

Table 7. List of undergraduate students mentored at Purdue.

Name	Department	Work Period
Victoria Wilson[1]	Horticulture and Landscape Architecture	2016
Alexander Miller[1]	Horticulture and Landscape Architecture	2017-2018
Stephanie Millet[1]	Horticulture and Landscape Architecture	2018
Farhan Sohail	Mechanical Engineering	2018-19
Manuel Perez[1]	Agric. Biological Engineering	2019
Uel Kwame	Agric. Biological Engineering	2019
Tej Shah	Agric. Finance Management	2019-20
Juliana Brustolin	Agric. Biological Engineering	2018-20
Jacob Brasseur[1]	Horticulture and Landscape Architecture	2020-21

[1] Secured jobs in Controlled Environment Agriculture industry upon completion of work

TEACHING

Courses Taught and Evaluation of Course and Instructor

(i) HORT 31900. Controlled Environment Production of Horticultural Crops

Enrollment:
2018: 13
2019: 9
2020: 24
2021: 36

Evaluations:
2018: (11/12 students): Overall rating for course: 4.1/5.0; Overall rating for instructor: 4.4/5.0
2019: (6/9 students): Overall rating for course 4.5/5.0; Overall rating for instructor: 4.5/5.0
2020: Student evaluations were not collected due to COVID)

Support to other courses in the department

Dr. Nemali provides guest lectures in Fundamentals of Horticulture (HORT 10100) during the fall and spring semesters, Greenhouse and Landscape Fundamentals for Educators (HORT 21200) in the spring semester, and Aquaponics (SFS 31100) in the fall semester on topics related to CEA and floriculture.

Capstone Course

Dr. Nemali sponsors a Capstone project 'APTUS: Analyzing Plant Traits Using Smartphone' involving Purdue Polytechnic undergraduate students to develop a smartphone app for growers to utilize the 'smart' sensing technology on their phones for managing fertilizer application in floriculture production.

MEDIA APPEARANCES

Table 8. List of media appearances since 2016

Month, Year	Publisher	Title
Oct, 2016	Purdue Agri News	Indiana FFA Leaders Talk Flowers
Sep, 2017	Purdue Ag Exposure	What's behind the curtains? Hydroponics at Purdue University
Aug, 2018	Agriculture News, Purdue University	Purdue University greenhouse workshop aims to promote sustainable growing practices
Nov, 2018	News and Stories, Purdue University	Technology distilled to grow hydroponics
Dec, 2018	News and Stories, Purdue University	10 most read stories of 2018
Jan, 2019	News and Stories, Purdue University	Purdue helps Egypt go with the flow
May, 2019	Envision Magazine	An inside take on agriculture
May, 2019	Greenhouse Management	Phone Home
Jul, 2019	Nursery Management	Monitoring plant quality with next generation sensors
Sep, 2019	Agriculture News, Purdue University	Purdue University workshop to feature hydroponic technology
Sep-19	Purdue Agriculturalist	Researcher driven to keep learning and sharing
Oct, 2019	Greenhouse Management	Monitoring growth of bedding plant seedlings using images
Dec, 2019	Agriculture News, Purdue University	Purdue Extension honors outstanding service at Annual Professional Development Conference
Jun, 2020	American Floral Endowment	Smart sensors for measuring plant nitrogen content
Jun, 2020	Greenhouse Grower	How Smart Sensors Can Help You Better Manage Nitrogen Content in Annuals
Jul, 2020	Floral Daily	Smart sensors for measuring plant nitrogen content
Jan, 2021	IndyStar	What should I do to keep my plants alive during winter
Mar, 2021	Indiana Environmental Reporter	Controlled Environment Agriculture and Vertical Farming

ADMINISTRATIVE SERVICE

(i). Departmental Committees and Service

- Committee Chair, HLA Safety Committee, (January 2018 – March 2020)
- Committee Chair, HLA Greenhouse Manager Search (2018)
- Committee Member, HLA Curriculum Changes (2017)
- Committee Chair, Diversity Lunch and Learn. (January 2017 – May 2019)
- Chair- Climate and Diversity Committee involved in developing a document for five-year academic program review (2018)

(ii). College and University Committee and Service

- Dept. Representative for Leadership Development and Certificate Program Committee (since January 2018)
- Committee Member, Search Committee, Director of Digital Phenomics (2018)
- Committee Member, Awards Committee (since January 2020)
- Dept. Representative for PK-12 Council (since 2020)
- Member, Minorities in Agriculture, Natural Resources and Related Sciences (MANRRS) Conference (2017)

Laura J. Dodds
Purdue University Cooperative Extension Services
Phone (317) 317-4174; ljdodds@purdue.edu

Professional Preparation

Indiana University, Bloomington, IN	Human Development & Family Studies	BS, 1999
Indiana University, Indianapolis, IN	Masters in Public Administration	MS, 2006
Indiana University, Indianapolis, IN	American Studies	PhD candidate, 2023

Professional Experience

Professional Experience:

2020-present	County Extension Director, *Purdue Extension Marion County*, Indiana
2008-2020	Executive Director, Program Director, *TechPoint Foundation for Youth*, Indiana
2006-2008	Asst. Director of Development, Indiana University*, Herron School of Art & Design*, Indianapolis, Indiana
1999-2004	Unit Director, Program Director, *Boys & Girls Clubs of Indianapolis-LeGore Unit*, Indianapolis, Indiana

Additional Elected and Volunteer Positions:

- Board member, Executive Committee*, Indy Food Council*, 2018-Present
- Advisory Committee*, Food Comida Rawl 317*, 2020-Present
- Board member, *Math Pentathlon*, 2016- Present
- Child & Youth Certification- Professional Level, Issuing authority *Child & Youth Care Certification Board*
- Advisory Board*, State Robotics Initiative*, City of Indianapolis, Indiana 2015-2019
- Master Gardener Intern, *Purdue Cooperative Extension*, Marion County, Indiana 2017-2019
- Champions Board, *National Girls Collaborative*, 2017-2018

Consultancy:

Strategic Planning Consultant, Indy Food Council, Indianapolis Indiana 2018-2019

Awards, Honors, Honorary Service

- Leading Light Award Nominee, *Women & Hi Tech*, 2018
- Fellow-Executive Level, *The Journey Fellowship*, 2017
- Young Professional of the Year, *Planned Parenthood of Indiana and Kentucky*, 2009
- LEAD Scholarship Recipient and Graduate, *SKL Leadership Association*, 2007
- The Learning Club Scholarship Recipient and Graduate, *Boys & Girls Clubs of America*, 2004

DEPARTMENT OF HEALTH & HUMAN SERVICES

Program Support Center
Financial Management Portfolio
Cost Allocation Services

1301 Young Street, Room 732
Dallas, TX 75202
PHONE: (214) 767-3261
FAX: (214) 767-3264
EMAIL: CAS-Dallas@psc.hhs.gov

April 17, 2017

Kathleen Thomason
Interim Comptroller
Purdue University
Kurz Purdue Technology Center
1281 Win Hentschel Blvd, STE 1100
West Lafayette, IN 47906-4182

Dear Ms. Thomason:

A copy of the indirect cost Rate Agreement is being sent to you for signature. This Agreement reflects an understanding reached between your organization and a member of my staff concerning the rate(s) that may be used to support your claim for F&A and fringe benefit costs on grants and contracts with the Federal Government.

Please have the Agreement signed by an authorized representative of your organization, email to me, retaining a copy for your files. Our email address is cas-dallas@psc.hhs.gov. We will reproduce and distribute the Agreement to the appropriate awarding organizations of the Federal Government for their use.

The Office or Management and Budget (OMB) has requested that we reach an agreement with each institution on components for the published F&A cost rates. The attached form(s) are provided for that purpose. Please sign the form(s) and return them with the agreement.

An F&A cost proposal, together with supporting information, are required to substantiate your claim for F&A costs under grants and contracts awarded by the Federal Government. Thus your next F&A cost proposal for fiscal year ending June 30, 2020 is due in our office by December 31, 2020.

Sincerely,

Arif M. Karim -A

Digitally signed by Arif M. Karim -A
DN: c=US, o=U.S. Government, ou=HHS, ou=PSC, ou=People, cn=Arif M. Karim -A, 0.9.2342.19200300.100.1.1=2000212895
Date: 2017.04.26 23:05:34 -05'00'

Arif Karim
Director
Cost Allocation Services

Enclosures

PLEASE SIGN AND RETURN VIA EMAIL A COPY OF THE RATE AGREEMENT

COLLEGES AND UNIVERSITIES RATE AGREEMENT

EIN: 1356002041A1

ORGANIZATION:
Purdue University
Office of the Comptroller
Kurz Purdue Technology Center
1281 Win Hentschel Blvd, STE 1100
West Lafayette, IN 47906-4182

DATE:04/17/2017

FILING REF.: The preceding agreement was dated 02/07/2014

The rates approved in this agreement are for use on grants, contracts and other agreements with the Federal Government, subject to the conditions in Section III.

SECTION I: Facilities And Administrative Cost Rates

RATE TYPES: FIXED FINAL PROV. (PROVISIONAL) PRED. (PREDETERMINED)

	EFFECTIVE PERIOD				
TYPE	**FROM**	**TO**	**RATE(%)**	**LOCATION**	**APPLICABLE TO**
PRED.	07/01/2014	06/30/2017	55.00	On Campus	Organized Research
PRED.	07/01/2014	06/30/2017	54.00	On Campus	Instruction
PRED.	07/01/2014	06/30/2017	38.00	On Campus	Other Sponsored Activities
PRED.	07/01/2013	06/30/2017	26.00	Off Campus	All Programs
PRED.	07/01/2017	06/30/2021	55.00	On Campus	Organized Research
PRED.	07/01/2017	06/30/2021	54.00	On Campus	Instruction
PRED.	07/01/2017	06/30/2021	38.00	On Campus	Other Sponsored Activities
PRED.	07/01/2017	06/30/2021	26.00	Off Campus	All Programs
PROV.	07/01/2021	Until Amended			Use same rates and conditions as those cited for fiscal year ending June 30, 2021.

*BASE

Modified total direct costs, consisting of all direct salaries and wages, applicable fringe benefits, materials and supplies, services, travel and up to the first $25,000 of each subaward (regardless of the period of performance of the subawards under the award). Modified total direct costs shall exclude equipment, capital expenditures, charges for patient care, rental costs, tuition remission, scholarships and fellowships, participant support costs and the portion of each subaward in excess of $25,000. Other items may only be excluded when necessary to avoid a serious inequity in the distribution of indirect costs, and with the approval of the cognizant agency for indirect costs.

SECTION II: SPECIAL REMARKS

TREATMENT OF FRINGE BENEFITS:

The fringe benefits are specifically identified to each employee and are charged individually as direct costs. The directly claimed fringe benefits are listed below.

TREATMENT OF PAID ABSENCES

Vacation, holiday, sick leave pay and other paid absences are included in salaries and wages and are claimed on grants, contracts and other agreements as part of the normal cost for salaries and wages. Separate claims are not made for the cost of these paid absences.

OFF-CAMPUS DEFINITION: For all activities performed in facilities not owned by the institution and to which rent is directly allocated to the project(s), the off-campus rate will apply. Actual costs will be apportioned between on-campus and off-campus components. Each portion will bear the appropriate rate.

EQUIPMENT DEFINITION:
Equipment means an article of nonexpendable, tangible personal property having a useful life of more than one year and an acquisition cost of $5,000 or more per unit.

FRINGE BENEFITS:
FICA
403(b) Defined Contribution Plan
Retirement
Worker's Compensation
Life Insurance
Unemployment Insurance
Health Insurance
Staff and Grad Staff Tuition Remission
Disability Insurance
Liability and Fidelity Insurance

The MTDC exclusion for rental costs relates to building/space rental costs, not equipment rental costs, unless the equipment rental cost is significantly high and may skew the distribution of indirect costs such as an item of equipment costing over $10,000 in rental costs.

Per 2 CFR 200.414(g) - A rate extension has been granted.

Next Proposal Due:

The next indirect cost proposal based on actual costs for the fiscal year ending 06/30/2020, is due by 12/31/2020.

The off campus Purdue University rates cited above apply also to the Purdue International, Inc., EIN# 31-0958507

SECTION III: GENERAL

A. LIMITATIONS:

The rates in this Agreement are subject to any statutory or administrative limitations and apply to a given grant, contract or other agreement only to the extent that funds are available. Acceptance of the rates is subject to the following conditions: (1) Only costs incurred by the organization were included in its facilities and administrative cost pools as finally accepted: such costs are legal obligations of the organization and are allowable under the governing cost principles; (2) The same costs that have been treated as facilities and administrative costs are not claimed as direct costs; (3) Similar types of costs have been accorded consistent accounting treatment; and (4) The information provided by the organization which was used to establish the rates is not later found to be materially incomplete or inaccurate by the Federal Government. In such situations the rate(s) would be subject to renegotiation at the discretion of the Federal Government.

B. ACCOUNTING CHANGES:

This Agreement is based on the accounting system purported by the organization to be in effect during the Agreement period. Changes to the method of accounting for costs which affect the amount of reimbursement resulting from the use of this Agreement require prior approval of the authorized representative of the cognizant agency. Such changes include, but are not limited to, changes in the charging of a particular type of cost from facilities and administrative to direct. Failure to obtain approval may result in cost disallowances.

C. FIXED RATES:

If a fixed rate is in this Agreement, it is based on an estimate of the costs for the period covered by the rate. When the actual costs for this period are determined, an adjustment will be made to a rate of a future year(s) to compensate for the difference between the costs used to establish the fixed rate and actual costs.

D. USE BY OTHER FEDERAL AGENCIES:

The rates in this Agreement were approved in accordance with the authority in Title 2 of the Code of Federal Regulations, Part 200 (2 CFR 200), and should be applied to grants, contracts and other agreements covered by 2 CFR 200, subject to any limitations in A above. The organization may provide copies of the Agreement to other Federal Agencies to give them early notification of the Agreement.

E. OTHER:

If any Federal contract, grant or other agreement is reimbursing facilities and administrative costs by a means other than the approved rate(s) in this Agreement, the organization should (1) credit such costs to the affected programs, and (2) apply the approved rate(s) to the appropriate base to identify the proper amount of facilities and administrative costs allocable to these programs.

BY THE INSTITUTION:

Purdue University

(INSTITUTION)

Kathleen Thomason

(SIGNATURE)

Kathleen Thomason

(NAME)

INTERIM COMPTROLLER

(TITLE)

5/1/17

(DATE)

ON BEHALF OF THE FEDERAL GOVERNMENT:

DEPARTMENT OF HEALTH AND HUMAN SERVICES

(AGENCY)

Arif M. Karim -A

Digitally signed by Arif M. Karim -A
DN: c=US, o=U.S. Government, ou=HHS, ou=PSC, ou=People, cn=Arif M. Karim -A, 0.9.2342.19200300.100.1.1=2000212895
Date: 2017.04.26 23:03:10 -05'00'

(SIGNATURE)

Arif Karim

(NAME)

Director, Cost Allocation Services

(TITLE)

4/17/2017

(DATE) 5043

HHS REPRESENTATIVE: Matthew Dito

Telephone: (214) 767-3261

COMPONENTS OF PUBLISHED F&A COST RATE

INSTITUTION: **Purdue University**

FY COVERED BY RATE: **JULY 1, 2017 through JUNE 30, 2021**

APPLICABLE TO: **ORGANIZED RESEARCH**

RATE COMPONENT:	ON CAMPUS	OFF CAMPUS
Building Depreciation	5.3	
Equipment Depreciation	5.2	
Interest	1.2	
Operation & Maintenance	15.8	
Library	1.5	
Utility Cost Allowance	0.0	
Administration*	26.0	26.0
TOTAL	55.0	26.0

* Reflects provisions of Appendix III to Part 200 of Uniform Guidance—Indirect (F&A) Costs Identification and Assignment, and Rate Determination for Institutions of Higher Education (IHEs), C.8. dated December 26, 2013.

CONCURRENCE:

Purdue University
(Institution)

Kathleen Thomason
(Signature)

Kathleen Thomason
(Name)

INTERIM COMPTROLLER
(Title)

5/1/17
(Date)

Hawthorne the ♥ of the Community

Indiana State Department of Agriculture
Specialty Crop Block Grant Program
1 N Capitol Ave.
Indianapolis, IN 46204

March 20, 2021

Dear Indiana State Department of Agriculture:

Hawthorne Center is thrilled to partner with Purdue Extension beginning in 2021 through a new hydroponics initiative that will produce nutrient-rich, organic, leafy greens at the 16Tech Innovation District.

Hawthorne Center is located at 2440 W Ohio Street, in the Near West neighborhood. We annually serve 300 - 500 neighbors and families, approximately 95% of which are food insecure. Purdue Extension's year-round donation of leafy greens to the Hawthorne Center food panty will allow us to share 275-550 servings of organic local greens to our neighbors each month. This opportunity will improve our ability to provide fresh, healthy produce to the community.

In addition to receiving donated produce from Purdue Extension, we will partner to provide youth and family programming focused on nutrition, at-home and containing gardening, and cooking education.

Thank you for considering this proposal. We know our Near West neighbors and families deserve fresh, nutritious food and this partnership will help us reach our food security goals.

Thank you,

Dawn Dunderdale, Director of Program and Services
Hawthorne Community Center
2440 W Ohio Street, Indianapolis, IN 46222
ddunderdale@hawthornecenter.org

MATCHBOOK
LEARNING

Indiana State Department of Agriculture
Specialty Crop Block Grant Program
1 N Capitol Ave.
Indianapolis, IN 46204

March 18, 2021

Dear Reviewer Committee-

Thank you for the opportunity to share our support for Purdue University Extension's 2021 Specialty Crop Block Grant proposal.

Matchbook Learning at Wendell Philips 63 is an innovation school of Indianapolis Public Schools. Matchbook Learning was formed in 2011 as a national non-profit school turnaround management organization, the first of its kind to turnaround some of our nation's underperforming public schools using a student-centered, competency-based, blended model of school.

Currently, Matchbook Learning serves 658 students in grades k-8 on the Near West side of Indianapolis. Our students are majority-minority with 94% identifying as non-white and 98% qualifying for free or reduced-priced meals. Matchbook Learning students live and play in Haughville, the Near West neighborhood surrounding the school and the 16 Tech Innovation District.

We are in support of Purdue Extension's Specialty Crop Block Grant Program application. We look forward to engaging our students in the opportunity to learn about controlled environment growing, nutrition, basic cooking skills, Indiana agriculture, and agriculture careers through this partnership.

Thank you,

Dr. Amy Swann

Dr. Amy Galloway Swann
Chief Executive Officer / Superintendent
Matchbook Learning
1163 N Belmont Ave
Indianapolis, IN 46222
amy@matchbooklearning.com

Indiana State Department of Agriculture
Specialty Crop Block Grant Program
1 N Capitol Ave.
Indianapolis, IN 46204

March 18, 2021

Dear Grant Program Reviewers-

Thank you for the opportunity to introduce you to 16 Tech, an urban innovation district being developed in the historic Riverside neighborhood and within the Indiana Avenue Cultural District on the northwestern edge of downtown Indianapolis. The AMP is an expansive marketplace dedicated to showcasing and elevating local culinary entrepreneurs and vendors located in the heart of 16 Tech's headquarters. The AMP is home to seven restaurant stalls, a European-style market, a container-based food hall with communal seating, a full-service bar and restaurant, a community prep kitchen, and a culinary incubator.

The AMP is committed to providing guests who visit the space, and the community surrounding the space, with a one-of-a-kind experience. With this commitment in mind, we intend to create a long-term partnership with Purdue University Cooperative Extension. As one of our lead Community Outreach partner's, Extension will provide agriculture and nutrition education at The AMP to hundreds of visitors each year. We look forward to providing space for Extension educators to showcase innovations in indoor organic gardening through hydroponics displays and classes, nutrition education, and cooking demonstrations within a dedicated restaurant stall. The AMP is well-located and in a unique position to facilitate these important programs for our neighbors who are often underserved and underappreciated.

We are in support of Purdue Extension's Specialty Crop Block Grant Program application. We look forward to ensuring an impactful, sustainable, and mutually beneficial partnership between Purdue Cooperative Extension and The Amp for years to come as we build our presence and grow our impact in Indianapolis.

Sincerely,

Craig Baker

Concept Developer for 16 Tech and he AMP

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