HONORS BIOLOGY

Bayonne High School
2017-2018 School Year
Mr. A. G. Kuziola & Mrs. S. L. Stamos

June 2017

Dear Incoming Student and Parent/Guardian:

We are pleased to welcome you to Honors Biology at Bayonne High School. This course is designed to expose you to a variety of relevant topics in the field of Biology, as well as honing a variety of problem solving and critical thinking skills, at an advanced level. We look forward to meeting you and learning more about your personal talents and interests, and using that information to present this course in a way that is challenging, yet both exciting and engaging.

To prepare you for this experience, you will be assigned a mandatory Summer Assignment to complete, which will be due the 4th day of school, Monday, September 14, 2015. This is not "busywork," and certainly is not intended to detract from your summer vacation, but rather is a series of carefully constructed assignments designed to stimulate scientific thinking over the course of our summer recess. Among other tasks, it is a review of some of the mathematical and scientific principles we will expect you to know upon entering our class in September. Practicing these skills over the summer will keep you familiar with the material. Additionally, there are assignments related to some of the new skills and material we will be learning in the coming year, including careers in biology, being able to read scientific journal articles with comprehension, human ecological impacts, and current events in the field. Completing these assignments will give you a good foundation and a context in which to place the new material come the Fall.

This is also your first opportunity to demonstrate your Honors-level work ethic in writing. This assignment is the academic equivalent of a social first impression, and as such we expect you to take pride in your final product. Detailed instructions for each component of the assignment can be found on the following pages. We look forward to reviewing your work in September. Should you misplace your assignments, please visit http://www.bhsbiodome.org to access this information. (Bookmark this site! You will be using it a lot next year.).

Over the summer, Mr. Kuziola can be reached at akuziola@bboed.org and Mrs. Stamos can be reached at sstamos@bboed.org should you have any questions about the assignments. We will respond as quickly as we can; however, like you, we are on summer break as well and may not be immediately available to respond to your questions. Please be patient, and do not wait until the last minute!

We congratulate you on your acceptance into the Honors program, and are delighted to have you enrolled in our class. We look forward to meeting you!

Sincerely,

Mr. A. Kuziola & Mrs. S. Stamos

General Instructions

All Summer Assignments are to be TYPED, EXCEPT your vocabulary flash cards and unit conversions. Each assignment is fully explained in detail. Any task that needs to be completed **is in bold typeface**.

If you do not have a computer, but have a reasonably modern smartphone, that device may work, if it has apps for typing documents (e.g. Pages, Google Docs, etc.). However, you must have the ability to produce a document of honors academic quality. This means no "screen shots" of your Notepad, assignments pasted into e-mails, etc. It should be reasonably well-formatted with justified headings, standard font sizes, etc. Summer Assignments can be e-mailed as an attachment instead of printed; however, the due date is slightly earlier (8:30am, on the 2nd day of school).

Additionally, bringing your assignments in on a flash drive is acceptable.

The top-left of each assignment should be formatted in the following way:

Your Name (first and last)
Honors Biology
Name of Assignment
September 14, 2015

We have prepared the following checklist to help you ensure you have completed all assignments.

- [ ] Part 1: Careers in Biology, Parts A-G (TYPED)
- [ ] Part 2: Analyzing a Scientific Journal Articles, #1-17 (TYPED)
- [ ] Part 3: Analyzing Your Ecological Footprint, #1-5 (TYPED)
- [ ] Part 4A: Science Vocabulary Flash Cards
- [ ] Part 4B: Metric System Questions #1-14
- [ ] Part 4C: Scientific Notation #1-30
- [ ] Part 5: Scientific Method: 16 definitions (TYPED)
- [ ] Part 5: Scientific Method: Mrs. Crosswhite Fill-in-the-blanks (TYPED)
- [ ] Part 5: Scientific Method: #1-6 (TYPED)
- [ ] Part 6: 5 Biology Questions (TYPED)
- [ ] Part 7: Current Events (4) – Who/What/When/Where/How/Predict/Ask/Answer/Cite (TYPED)

Part I: Careers in Biology

*GO TO: http://www.aibs.org/careers

Answer the following questions/fill in the following blanks. The entire passage must be retyped, with the missing words underlined and/or highlighted. The first letter of each word is provided for your convenience.

A. Studying biology teaches us to ask q___________________(1), make o_(2), evaluate e_________(3), and solve p____________________________________(4). Biologists learn how living things work, how they i___________________________________(5) with one another, and how they evolve. They may study cells under a microscope, insects in a rainforest, viruses that affect human beings, plants in a greenhouse, or lions in the African grasslands. Their work increases our u_____________________(6) about the natural world in which we live and helps us address issues of personal well being and worldwide concern, such as e____________________(7) depletion, threats to human h_____________(8), and maintaining viable and abundant f__________(9) supplies.

B. What do biologists do? There are several career paths that a biologist can pursue:

1. R____________________(a): Research biologists study the natural world, using the latest scientific tools and techniques in both laboratory settings and the outdoors, to understand how living systems work. Many work in exotic locations around the world, and what they discover increases our understanding of biology and may be put to p______________________(b) use to find solutions to specific p__________________(c).

2. H___________________(a) care: Biologists may develop public health campaigns to defeat illnesses such as tuberculosis, _____________(b), cancer, and h____________(c) disease. Others work to prevent the spread of rare, deadly diseases, such as the now infamous E_____________(d) virus. V_____________________(e) tend to sick and injured animals, and doctors, d________________(f), n______________________(g), and other health care professionals maintain the general health and well being of their patients.

3. E_____________________________(a) management and conservation: Biologists in management and conservation careers are interested in solving environmental problems and p_________________________(b) the natural world for future generations. Park rangers protect state and national parks, help preserve their natural resources, and educate the general public. Zoo biologists carry out e______________________s_____________(c) recovery programs. In addition, management and conservation biologists often work with members of a community such as landowners and special interest groups to develop and implement management plans.

4. E______________________(a): Life science educators enjoy working with people and encouraging them to learn new things, whether in a c________________(b), a r________________(c) lab, the field, or a m__________________(d).

- **Colleges and universities**
- **Primary and secondary**
- **Science museums, zoos, aquariums, parks, and nature centers**

C. List 8 new directions in biological careers:

1. ____________________
2. ____________________
3. ____________________
4. ____________________
5. ____________________
6. ____________________
7. ____________________
8. ____________________

D. If you are planning a career in Biology, what should you do in high school?

1. ____________________
2. ____________________
3. ____________________
4. ____________________

E. . . . what should you do in college?

1. ____________________
2. ____________________
3. ____________________
4. ____________________

F. What is the job outlook for the future?

While there will always be a need for bright, energetic, and educated individuals with a strong understanding of biology, opportunities ___________(1) depending on the status of local and national economies. For current job outlook information, check the Occupational Outlook Handbook, published every two years by the US Bureau of Labor Statistics. The handbook is searchable by topic, and there are over ___________________________(2) job descriptions that match the keyword "biology."

Job growth is expected in a number of areas. What two specific areas is job growth expected to occur particularly?

3. ____________________
4. ____________________

G. What are the salaries for biologists?

A 2003 survey by AIBS in conjunction with the Abbot and Langer Company found that biologists with less than one year experience have a starting salary of around $_(1) per year. Data from a 2005 US Bureau of Labor Statistics report show that the field of life sciences as a whole has a mean annual salary close to $_ _______________________(2). As biologists gain more experience and education in their field, those in private industry may earn salaries of over $____(3), while those working in government, academia, and the nonprofit sector earn around $______________________ to $___________________(4). Those with over 30 years of experience have a median salary of around $_______________________(5). Keep in mind that salaries may vary greatly depending or g___(6)

location, job type, and experience and e________________________(7).

As you can see, higher salaries are found in private research companies and government agencies, where you may have more job security, advancement opportunities, and independence in your work.

8. How many sites are provided where you can find out more information about people who have become biologists? ____________

9. How many general career development and job hunting sites are provided? _____________________

Part II: Analyzing a Scientific Journal Article

Reading journal articles written by professional Biologists, understanding them, and analyzing their content can be a tremendously rewarding experience. We will take the opportunity to review many journal articles over the course of the year to enrich our understanding of our current topics and gain inspiration for our own scientific experiments. This part of your summer assignment will involve reading a scientific journal article and answering some basic questions about it. Please note: I realize this article may be intimidating. I do not expect you to understand the article in its entirety! Don't worry, we will go over this article together in September.

In class we will discuss how organisms interact with each other and their environment. This scientific journal article discusses an example of these interactions. If it is illegible, you can download the original PDF from our class web site.

1. Using a chart, list the 4 main parts of this scientific journal article and then describe what type of information is put into each section. (The first part of the article in italics is the "Abstract")

2. In the introduction, what is the information that is in parenthesis? For example: "In the early 1900s, kudzu was promoted as inexpensive forage in over-grazed pastures and for erosion control in the South (Piper, 1920)."

3. What broad types of background information did the writer provide in the introduction? List at least 3-5 examples.

4. What is the objective (purpose) of this study?

5. What is the hypothesis being tested in this study?

6. In what tense is the materials and methods section written? (past, present or future?)

7. What is a control in an experiment? List at least 2 from the experimental setup.

8. What is a variable in an experiment? Identify one variable in this experiment.

9. Besides paragraphs stating the results, what else is found in the results section?

10. How is the labeling of the graphs different from the labeling of the table? Identify WHERE the label is.

11. In the discussion, what is the overall conclusion of the study?

12. Is there any experimental error mentioned in the discussion section? If so, explain.

13. How many references are listed on the citation page (Literature cited)?

14. Was the hypothesis correct? Explain.

15. Why is the article important to you, or anyone?

16. What are two new, interesting pieces of information you learned from this article?

17. Write down two unfamiliar words and find their definitions.

Biocontro/ Science and Technology (2002) 12, 75-82

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Biological Control of Kudzu *(Pueraria lobata)* with an Isolate of *Myrothecium verrucaria*

C. DOUGLAS BOYETTE, [1] H, LYNN WALKER [2] AND HAMED K. ABBAS [1]

[1] *USDA-ARS, Southern Weed Science Research Unit, Stoneville, MS, USA;*
[2] *School of Biological Sciences, Louisiana Tech University, Ruston, LA, USA*

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An isolate of the fungus Myrothecium verrucaria *(MV) was evaluated for biocontro l potential against kudzu* (Pueraria lobat a). *In greenhouse tests,* MV *was highly virulent against kudzu in the absence of dew when conidia were formulated in 0.2% Silwet L-77 surfactant (SW). Inoculum concentrations* x *10* ^{7} *conidia ml* $^{-1}$ *were required to satisfactorily control plants in the third leaf stage and larger. In controlled environment experiments, kudzu mortality was greater at higher temperatures (25 - 400C) than at lower temperatures (10- 20°C), although pathogenesis and mortality occurred at all temperatures tested. In field tests, transplanted kudzu seedlings in the 2-3 leaf growth stage treated with* MV *at 2* x *10* ^{7} *conidia ml* $^{-1}$ *in 0.2% SW, exhibited leaf and stem necrosis within 24 hfollowing inoculation, with mortality occurring within 96 h. After 7 days, 100% of inoculated kudzu plants were killed in plots treated with the fungus/surfactant mixtures. Similar results were observed in a naturally occurring kudzu population, where 100% control occurred within 14 days after inoculation with 2* x *10* ^{7} *conidia ml* $^{-1}$ *in 0.2% SW In summary,* MV *effectively controlled kudzu in the absence of dew over a wide range of physical and environmental conditions and under field conditions. These results indicate that, when properly formulated,* MV *has potential as a valuable bioherbicide for controlling kudzu.*

Keywords: Myrothecium verrucaria, *biological control, bioherbicide, kudzu,* Pueraria lobata

INTRODUCTION

Kudzu *[Pueraria lobata* (Willd.) Ohwi] is a perennial leguminous vine native to eastern Asia. About fifteen species of *Pueraria* occur worldwide, but none are native to North or South America. Kudzu was introduced into the eastern and southern USA in the late 1800s (McKee & Stephens, 1943). In the early 1900s, kudzu was promoted as inexpensive forage in over-grazed pastures and for erosion control in the South (Piper, 1920). The US Soil Erosion Service provided over 80 million kudzu seedlings to southern homeowners for

Correspondence to: C. D. Boyette, Southern Weed Science Research Unit, 141 Experiment Station Road, Stoneville, MS 38776, USA Tel: +I 662 686 5217; Fax: +I 662 686 5422; E-mail: dboyette@a rs.usda.gov

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erosion control and land revitalization (Bailey, 1944). The federal government offered up to \$3.2 per ha as an incentive for farmers to plant kudzu, and by 1946, over 1.22 million ha had been planted. By the early 1950s, kudzu had spread throughout the southeastern USA and was no longer listed as a permissible cover plant under the Agricultural Conservation Program. By 1970, the US Department of Agriculture listed kudzu as a common weed in the South (Everest *et al.*, 1994), and in 1993 it was listed in a report by Congress as one of the most harmful nonindigenous plant species in the USA (United States Congress, OTA, 1993). In 1998, kudzu was added to the Federal Noxious Weed List by Congressional action, thus restricting its spread over state boundaries. At present, kudzu occurs in the USA from Florida to New York, westward to central Oklahoma and Texas, with the heaviest infestations in Alabama, Georgia and Mississippi (Miller, 1997).

Monetary losses from kudzu result mainly from reduced land productivity, primarily in forested areas. Losses in infested forests average \$19.4 ha^{-1} $year^{-1}$ (Beckwith & Dangerfield, 1996). These losses in potential productivity have been estimated to be \$336 million each year for the 2.84 million infested hectares. Additional kudzu infestations have been estimated to be 48 600 ha $year^{-1}$, and thus, losses attributed to kudzu increase annually by nearly \$6 million. These estimates do not include costs for controlling the weed, which may amount to \$81 ha^{-1} $year^{-1}$ (Miller, 1997). Kudzu also causes losses in biodiversity and reduced aesthetic values in recreational areas such as national parks, forests, and scenic highways in the southern and eastern USA.

Kudzu produces a large, starchy tuber from which annual regrowth occurs. Foliar sprays of picloram, picloram plus 2,4-D, dicamba plus 2,4-D, and tebuthiuron are effective after full leaf expansion occurs. Repeat sprays are necessary after regrowth appears. Herbicide treatments require yearly applications for up to 10 years for complete control. Burning and grazing may also be effective in some cases but are impractical in most heavily infested areas such as urban areas, and highway rights-of-way (Everest *et al.*, 1994).

Kudzu in the USA is represented by only one species *(P. lobata)* with apparently little genetic variability within the US population (Miller, 1997). Weed populations that exhibit limited genetic variability are considered as good candidates for biological control (Templeton & Trujillo, 1981).

Myrothecium verrucaria (Alb. & Schwein.) Ditmar:Fr. isolated from diseased sicklepod *(Senna obtusifolia* L.) exhibited excellent biocontrol potential for several weed species, including the legumes sicklepod and hemp sesbania [*Sesbania exaltata* (Raf.) Rydb. ex A.W Hill], when formulated with the surfactant Silwet L-77 (a silicone-polyether copolymer spray adjuvant, OSi Specialties, Inc., Charlotte, NC, USA) in the absence of dew (Walker & Tilley, 1997). Kudzu was not examined as a potential host in this report and has not been previously reported as a host of *M. verrucaria.* In preliminary greenhouse tests, we found that the pathogen was highly virulent to kudzu in the absence of dew. The objectives of this study were to determine disease development and control of kudzu as influenced by inoculum concentration, plant growth stage, and post-inoculation temperature. In addition, bio-herbicidal efficacy was examined under field conditions.

MATERIALS AND METHODS

Inoculum Production

Inocula (conidia) of *M. verrucaria* for all experiments were produced in Petri dishes containing potato dextrose agar (PDA; Difco Laboratories, Detroit, MI, USA)'. The growth medium was inoculated by flooding each Petri dish with 3 ml of a suspension containing 2×10^6 conidia ml^{-1}. The inoculated plates were inverted and placed on open-mesh wire shelves of an incubator (Precision Scientific Inc., Chicago, IL 60647, USA) at 28oC for 5 days. Photoperiods (12 h) were provided by two 20 W cool-white fluorescent lamps positioned in the incubator door. Light intensity at dish level was approximately 200 $\mu mol\ m^{-2}\ s^{-1}$ photosynthetically active radiation as measured with a light meter. Conidia were rinsed from experiment, environmental conditions at the time of inoculation and for 24 h following treatment were: temperature at inoculation, 33°C with a RH of 56%. The high temperature for the 24 h period was 34°C, and the low temperature was 23°C. Maximum RH was 94%, with a light dew that lasted for a period of 3 h. For the August 5 experiment, environmental conditions at the time of inoculation and for 24 h following treatment were: temperature at inoculation, 34°C with a RH of 39%. The high temperature for the 24 h period was 36°C, and the low temperature was 24°C. Maximum relative humidity was 94%, with a light dew that lasted for a period of 3 h. The plants were monitored for disease development at 5-day intervals for 15 days, then harvested for dry weight determinations, as described previously for growth chamber experiments. The data presented represent weed mortalities recorded 15 days after inoculations. A randomized complete block design was utilized, and the treatments were replicated three times. Data from the June and August experiments were pooled following subjection to Bartlett's test for homogeneity (Steele & Torrey, 1980), and analyzed using analysis of variance.

A field test was conducted on July 19, 1998 in a site near Greenwood, MS that was heavily infested with a naturally occurring population of kudzu plants. Treatments consisted of: (1) 0.2 x 10^7 conidia ml^{-1} in distilled water; (2) 2 x 10^7 conidia ml^{-1} in distilled water; (3) 0.2 x 10^7 conidia ml^{-1} in 0.2% Silwet L-77 surfactant; (4) 2 x 10^7 conidia ml^{-1} in 0.2% Silwet L-77 surfactant; (5) 0.2% Silwet L-77 surfactant only; and (6) untreated controls. Spray volumes were applied at approximately 450 l ha^{-1} with backpack sprayers. This rate of spray resulted in inoculum densities of 9 x 10^{11} conidia ha^{-1}, and 9 x 10^{12} conidia ha^{-1}, respectively, for the low and high inoculum density rates. Plot sizes were 9.9 m^2 and treatments were replicated four times. Environmental conditions at the time of inoculation and for 24 h following treatment were: temperature at inoculation, 34°C with a RH of 50%. The high temperature for the 24 h period was 3rC, and the low temperature was 26°C. Maximum RH was 97%, with a light dew that lasted for a period of 5 h. Kudzu control was assessed visually by comparing the percentage of necrotic tissue in the treated plots with the tissue in the untreated plots. Estimates of control were made at weekly intervals for 4 weeks. The data presented represent weed mortalities recorded 28 days after inoculations. The test was arranged in a completely random design with three replications. Means were separated using Fisher's Protected Least Significant Difference (FLSD) at $P = 0.05$.

RESULTS AND DISCUSSION

Effect of Inoculum Concentration and Plant Growth Stage

There were significant increases in plant mortality at all growth stages as the inoculum density increased from 2 x 10^5 to 2 x 10^7 conidia ml^{-1} (Figure 1). The fungus applied at inoculum densities of 2 x 10^7 and 2 x 10^8 conidia ml^{-1} killed more plants when applied at lower densities. An inoculum density of 2 x 10^6 conidia ml^{-1} killed 40-50% of the weeds at the cotyledonary growth stage, but was less efficacious on older plants. Seedlings in the cotyledonary, 1-3-leaf, and 4-6 leaf stages were effectively killed with 2 x 10^7 conidia ml^{-1}, but plants in the 7-8-leaf stage required an inoculum concentration of 2 x 10^8 conidia ml^{-1} for 90% control (Figure 1).

Effect of Post-inoculation Temperature

Pathogenesis and mortality occurred at all temperatures that were tested; however, greater disease development and kudzu control occurred at higher temperatures (Figure 2). Disease symptoms were characterized by necrotic flecking which occurred within 6 h after inoculation at 30-40°C with slower disease development at lower temperatures (Figure 2). Disease symptoms progressed from inoculated cotyledons and leaves to produce stem lesions within 48 h after inoculation. These results indicate that this pathogen could be used in midsummer when similar temperatures occur in kudzu-infested regions of the southeastern USA.

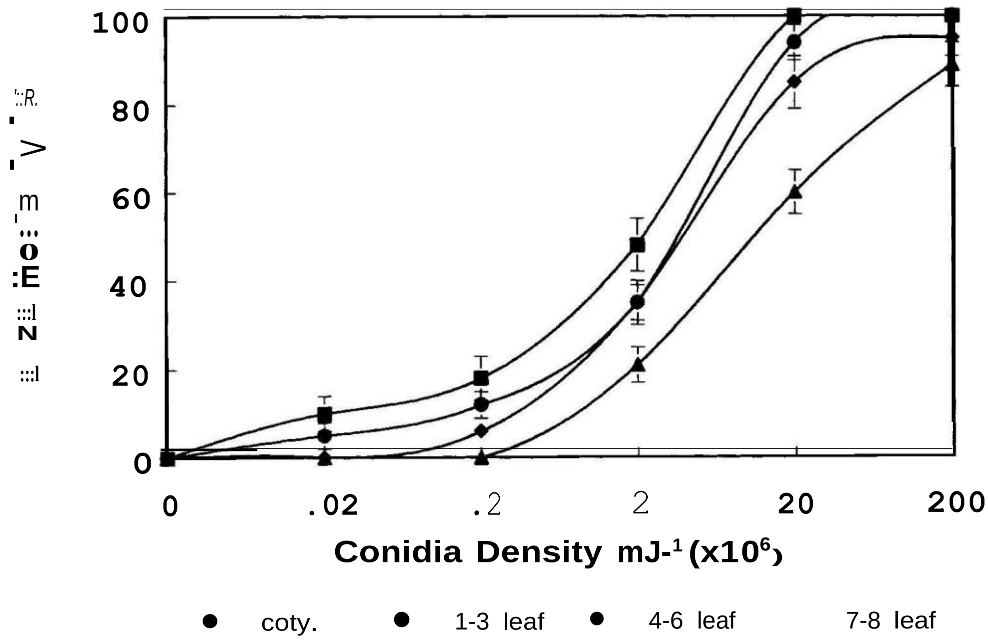

FIGURE 1. Effects of inoculum concentration and plant growth stage on biocontrol of kudzu *(Pueraria lobata)* by *Myrothecium verrucaria* in greenhouse experiments. Regression equations for the curves are: Cotyledonary, $y = 45.33 - 66.27x + 26.56x^2$, $r^2 = 0.96$; 1-3 leaves, $y = 47.67 - 67.16x + 24.71x^2$, $r^2 = 0.96$; 4-6 leaves, $y = 53.67 - 75.85x + 28.98x^2$, $r^2 = 0.94$; 5-7 leaves, $y = 27.67 - 36.49x + 11.11x^2$, $r^2 = 0.98$, where x represents plant growth stage (leaf number) and y represents weed mortality. Vertical bars represent 95% confidence intervals from two separate experiments, each consisting of three replications containing 10 plants per replication.

Field Experiments

In the microplot experiments, kudzu plants treated with the fungus/surfactant mixtures had developed leaf and stem necrosis within 24 h following inoculation, and were killed within 96 h. After 7 days, 100% of inoculated plants had been killed in plots treated with conidia/Silwet-L-77 suspensions (Table 1). No regrowth occurred on kudzu plants treated with the conidia/Silwet-L-77 suspensions during the 15 day time course of the experiments (data not shown). The fungus sporulated profusely on infected tissue and was easily reisolated. No visible damage or dry weight reductions were observed for kudzu plants in the untreated controls, for plants treated with surfactant only, or for plants treated with conidia suspended in distilled water only (Table 1).

Results observed in the natural kudzu infestation site were similar to the results obtained in the microplot experiments. Kudzu was completely controlled after 14 days in plots treated with 2 x 10^7 conidia ml^{-1} and surfactant applied at 450 l ha^{-1}. Kudzu control was significantly less in plots treated with either the fungus in water only or the fungus in surfactant suspension at a rate of 2 x 10^6 conidia ml^{-1} (Table 2). No regrowth occurred on vines that had been considered 'killed'; however, after 4 weeks, vines from the margins of untreated plots had begun to spread into treated areas where kudzu had been defoliated.

These results indicate that, when properly formulated, *M. verrucaria* can be a potential bioherbicide for controlling kudzu. Kudzu plants were effectively controlled in the absence of dew in greenhouse and growth chamber studies and under field conditions where temperatures approached or exceeded 40°C. The addition of Silwet L-77 to *M. verrucaria* conidial suspensions resulted in greatly increased mortality to kudzu, as was the case with

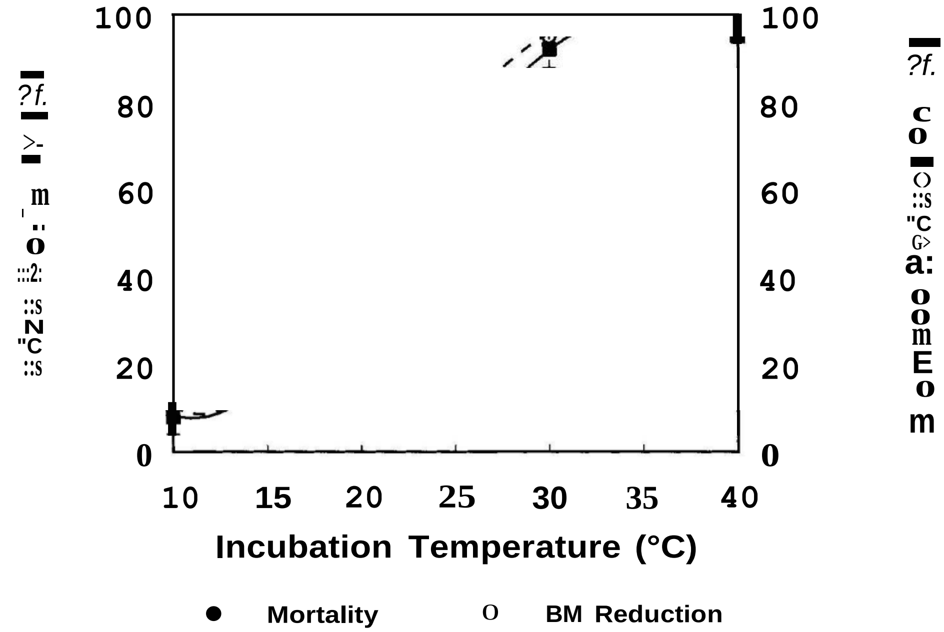

FIGURE 2. Effects of incubation temperature on mortality and biomass reduction of kudzu *(Pueraria lobata)* inoculated with *Myrothecium verrucaria* in growth chamber experiments. Regression equations for the curves are: Mortality; $y = 37 - 53.76x + 29.12x^2$, $r^2 = 0.96$, where x represents incubation temperature and y represents weed mortality; biomass reduction, $y = 56.43 - 84.67x + 45.79x^2$, $r^2 = 0.97$, where x represents incubation temperature and y represents biomass reduction. Vertical bars represent 95% confidence intervals. Means are from two separate experiments, each consisting of three replications containing 10 plants per replication.

TABLE 1. Biocontrol of kudzu *(Pueraria lobata)* with *Myrothecium verrucaria* in field microplots, Stoneville, MS, 1998

Treatment[a]	Mortality[b] (%)	Dry weight reduction (%)
Conidia + water[c]	0	0
Conidia + water + surfactant[d]	100	100
Water + surfactant[c]	0	0
Untreated	0	0

[a] Treated plants were sprayed at a rate of 450 l ha^{-1}.
[b] Plants were considered 'killed' when 100% necrosis occurred to individual plants.
[c] 2×10^7 conidia ml^{-1}.
[d] 0.2% Silwet L-77 surfactant.

other weeds that have been previously tested (Walker & Tilley, 1997). Silwet L-77 has been reported to provide enhanced wetting of plant foliage and to increase stomatal infiltration of aqueous solutions (Field & Bishop, 1988; Zabkiewicz & Gaskin, 1989) in several different plant species. The extremely low oil-water surface tension (20 dynes cm^{-1}) created by Silwet L-77 has been shown to facilitate direct penetration by bacterial cells of *Pseudomonas syringae* pv. *phaseolicola* van Hall, into kudzu stomata, thereby enhancing infection of kudzu by this bacterial pathogen (Zidak *et al.*, 1992). A possible explanation for the increased mortality to kudzu and other susceptible hosts is that the relatively small size of

TABLE 2. Biocontrol of a natural infestation of kudzu *(Pueraria lobata)* with *Myrothecium verrucaria*, Greenwood, MS 1998

Treatment[a]	Mortality (%)[b]
Conidia (2 x 10^6 ml^{-1}) + water	7
Conidia (2 x 10^7 ml^{-1}) + water	20
Conidia (2 x 10^6 ml^{-1}) + surfactant[c]	36
Conidia (2 x 10^7 ml^{-1}) + surfactant[c]	100
Surfactant[c] only	5
Untreated	0
FLSD (0.05)	7

[a]Applications were made with a backpack sprayer at a rate of 450 l ha^{-1}.

[b]Plants were considered 'killed' when 100% necrosis occurred to individual plants.

[c]0.2% Silwet L-77 surfactant in water.

M. verrucaria spores [6.5-8.0 x 2.0-3.5 μm] (Domsch *et al.*, 1980) may allow for the direct penetration of conidia, phytotoxic fungal metabolites, or both, into stomata of potential host plants such as sicklepod and kudzu when the fungus is formulated with Silwet L-77. Previous research has shown that sicklepod stomatal openings are large enough to accommodate direct penetration by fungal spores that are in the size range of *M. verrucaria* spores (Van Dyke & Trigiano, 1987). More research is required to determine the infection processes.

Myrothecium verrucaria has been reported as a weak pathogen on several plant species (Nguyen *et al.*, 1973; Domsch *et al.*, 1980; Yang & Jong, 1995a). Virulence of other *M. verrucaria* isolates can be influenced by manipulation of inoculum concentration (Yang & Jong, 1995a). Because of the interaction of the surfactant with the high inoculum levels, secondary spread of the pathogen to uninoculated plants was not observed in our research or in other reports (Yang & Jong, 1995b). Sporodochial fluids and culture filtrates of *M. verrucaria* and other *Myrothecium* species have been reported to contain several non-specific phytotoxins (Pawar *et al*, 1965; Cunfer & Lukezic, 1969; Jarvis *et al.*, 1985). In addition, some isolates of *M. verrucaria* have been reported to produce metabolites that are toxic to humans and livestock (Mortimer *et al.*, 1971; Domsch *et al.*, 1980; Jarvis *et al.*, 1985). We are conducting research to determine if the isolate used in our test produces potentially harmful substances, a critical point which should be addressed if this pathogen is to be used as a bioherbicide.

ACKNOWLEDGEMENTS

We thank J. R. McAlpine and B. J. Johnson for valuable technical assistance.

NOTE

1. Mention of a trademark, proprietary product, or vendor does not constitute a guarantee or warranty of the product by USDA-ARS or Louisiana Tech University and does not imply its approval to the exclusion of other products or vendors that may also be suitable.

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Part III: Your Ecological Footprint

We are organisms too, and we have a huge impact on other organisms and our environment, making us an important part of the ecosystem to study. In this activity you will be looking at how you impact the environment on a daily basis.

Instructions:

1. Go to the following website: http://www.earthday.net/footprint
2. Select the United States on the map.
3. Click on "Begin"
4. Click on "Get Started"
5. Choose a person to represent you then click on "OK"
6. Take the ecological footprint quiz. Answer the more detailed questions at the bottom of the screen.

Questions:

1. **How many planet Earths would we need if everyone lived like you?**

2. **How many acres does it take to support your lifestyle?**

3. **Click on Explore Scenarios. What are 3 things you could do to reduce your ecological footprint?**

4. **Click OK at the bottom of the explore scenarios screen. Click on "learn more about your footprint"**
   a. In your own words describe what an ecological footprint is.
   b. What does an ecological footprint measure?

5. **What are 3 other environmental issues that we face today?**

Part IV: Structure of Science Vocabulary, Measurements & the Scientific Method

4A: Science Vocabulary

Science is often challenging because of the vocabulary. It is very helpful if you are familiar with the prefix, suffix, and root words that science is based.

You need to make flash cards (or use a flash card app) to study the following. I will be checking your flash cards (or equivalent), even if you know these terms already, in September! We will be having a quiz in the first week of school on these terms.

term	Definition	term	definition
a-	without or lacking	micro-	small
ab-	away from	mono-	one
amphi-/amp-	of both kinds	multi-	many
anti-	Against	non-	not
aqua-	Water	omni-	all
auto-	Self	phag-	eat
bi-	Two	photo-	light
bio-	Life	pre-	before
chlor-	Green	prot-/proto-	first
cyt-	Cell	pseudo-	fake, false
de-	away from	sub-	under
derm-	Skin	tele-	at a distance
di-	Two	therm-	temperature
dis-/dif-	apart from, deprive	trans-	across, beyond
ect-	Outside	tri-	three
en-	In	trop-	turning
epi-	on, above	zo-	animal
extra-	outside, beyond		
gastro-	Stomach	-able/-ible	able, capable
geo-	Earth	-ectomy	cut out
hetero-	Different	-graph	instrument for making records
homo-	Same	-ism	act of, condition
hydro-	Water	-itis	inflammation
hyper-	over, above	-meter	measure
hypo-	under, below	-logy	study of
inter-	Between	-phyll	leaf
intra-	Within	-pod/-ped	foot
luna-	Moon	-scope	look, observe
macro-	Large		
meta-	Change		

4B. Metric System

In the science classroom we use the metric system, despite the United States still using the Imperial measurement system. The metric system is based on the number 10.

Please answer the following questions. You may need to use outside resources if you have trouble.

1. Why do we use the metric system, if the United States uses the Imperial system?
2. What is the base unit for volume?
3. What is the base unit for mass?
4. What is the base unit for length?
5. What is the base unit for temperature?

Convert the following metric problems.
Show your conversions. Show your work or no credit will be given!

6) 83 g = ____kg	**9) 250 cm = ____m**	**12) 7000 ml = __L**
7) 50 mg = ____g	**10) 32 m = ___mm**	**13) 12 L = ____ml**
8) 98 degrees F = _______C	**11) 14.3 m = _____km**	**14) 57 g= ____mg**

Remember:	King	Henry	Died	By	Drinking	Chocolate	Milk
	kilo	hecto	deca	(Base)	deci	centi	milli
	1000	100	10	1	0.1	0.01	0.001

$$F = \frac{9}{5}(C + 32)$$

$$C = \frac{5}{9}(F - 32)$$

Deca and Deci both start with *d*, but "deca" comes alphabetically before "deci" and comes first in the sentence.

4C: Scientific Notation

Express each of the following in standard form.

1. 5.2×10^{3}

2. 9.65×10^{-4}

3. 8.5×10^{-2}

4. 2.71×10^{4}

5. 3.6×10^{1}

6. 6.452×10^{2}

7. 8.77×10^{-1}

8. 6.4×10^{-3}

Express each of the following in scientific notation.

9. 78,000

10. 0.00053

11. 250

12. 2,687

13. 16

14. 0.0043

15. 0.875

16. 0.012654

Use the exponent function on your calculator (EE or EXP) to compute the following.

17. $(6.02 \times 10^{23})(8.65 \times 10^{4})$

18. $(6.02 \times 10^{23})(9.63 \times 10^{-2})$

19. $\frac{5.6 \times 10^{-18}}{8.9 \times 10^{8}}$

20. $(-4.12 \times 10^{-4})(7.33 \times 10^{12})$

21. $\frac{1.0 \times 10^{-14}}{4.2 \times 10^{-6}}$

22. $\frac{7.85 \times 10^{26}}{6.02 \times 10^{23}}$

23. $(-3.2 \times 10^{-7})(-8.6 \times 10^{-9})$

24. $\frac{(5.4 \times 10^{4})(2.2 \times 10^{7})}{4.5 \times 10^{5}}$

25. $\frac{(6.02 \times 10^{23})(-1.42 \times 10^{-15})}{6.54 \times 10^{-6}}$

26. $\frac{(6.02 \times 10^{23})(-5.11 \times 10^{-27})}{-8.23 \times 10^{5}}$

27. $\frac{(3.1 \times 10^{14})(4.4 \times 10^{-12})}{-6.6 \times 10^{-14}}$

28. $\frac{(8.2 \times 10^{-3})(-7.9 \times 10^{7})}{7.3 \times 10^{-16}}$

29. $\frac{(-1.6 \times 10^{5})(-2.4 \times 10^{15})}{8.9 \times 10^{3}}$

30. $(7.0 \times 10^{28})(-3.2 \times 10^{-20})(-6.4 \times 10^{35})$

Part V: The Scientific Method.

This is the standard that all scientist use to solve questions/ problems related to our world.

Define each of the following terms:

scientific method	**hypothesis**	**law**	**theory**	**data**
observation	**quantitative data**	**qualitative data**	**abiotic factors**	**biotic factors**
biodiversity	**independent variable**	**dependent variable**	**control variable**	**experimental group**
control group				

Read the scenario below and answer the questions that follow.

Mrs. Crosswhite wants to know the effect of different colors of light on the growth of plants. She believes that plants can survive best in white light. She buys 5 ferns of the same species, which are all approximately the same age and height. She places one in white light, one in blue light, one in green light, one in red light and one in the closet. All of the ferns are planted in Miracle-Grow and given 20 mL of water once a day for 2 weeks. Mrs. Crosswhite makes observations for two weeks.

Based on the data above—answer the following questions.

Hypothesis: If*______________________________, then*______________________________
Independent Variable: ________________________________
Dependent Variable: ___________________________
Control Group: _______________________________________
Experimental Group: ___________________________
Control Variables:______________________________

What types of measurements can Mrs. Crosswhite make on the plants to determine how they did in different types of light? ________________________

A hypothesis is written a particular way. Hypotheses are always written as an If.. then statement. Identify the hypothesis, the independent variable, the dependent variable, the control variable(s), and if an experiment were designed for each situation, the experimental group and the control group.

1. Does calcium help plants grow stronger stems?

    a. Hypothesis: *If plants are given a calcium supplement then their stems will grow stronger.*

    b. Independent Variable: *Calcium*

    c. Dependent Variable: *Strength of stems*

    d. Control Variable(s): *Plant species, amount of light, amount of water, size of pot*

    e. Experimental Group: *Plants receive calcium supplement*

    f. Control Group: *Plants do not receive calcium supplement*

2. **Will loud music affect the height of corn plants?**

3. **Will water affect mold growth?**

4. **Will growing tomato plants in water affect mass size?**

5. **Will salt affect the breathing rate of a goldfish?**

6. **Will the use of bug spray attract fewer mosquitoes?**

Part VI: *Your Own Biology Questions*

As you are enjoying your summer, whether it is while you are watching television or vacationing on the beach, think about the world around you scientifically.

This part of your summer assignment is to write down 5 questions you would like to have answered in Biology class next year. These should be thoughtful questions that ask "how" or "why."

Don't force these! The questions should come naturally based on something you are curious about. For example, "Why do antibiotics not work for Swine flu?"

Part VII: Current Events in Biology

Select four (4) articles taken from credible, national or global sources. At least one of the articles must be from a paper (not online) newspaper (e.g. Star Ledger, New York Times, Jersey Journal, etc.) or magazine (e.g. Time, Newsweek, National Geographic, etc.). None of the articles can be any older than June 1, 2013. Try to select articles that interest you.

Complete the following worksheet (retyped) for each article.

You must cite the article in proper MLA format at the end of your evaluation. An MLA citation guide is provided at the end of this packet. It is there for reference only.

Title of Article: ____

Source (where did you find it?) ____

WHO is this article about?

WHAT is this story about? List four facts and/or opinions related in your article *and identify them as facts or opinions.*

WHEN did this story take place? Is this a completely new event, or has something similar or related happened in the past? (For example, an article about the cicada invasion this summer might discuss the fact that this happens every 17 years). Be careful and THINK! Explain.

WHERE is this event or issue occurring? (Specify city, country, region, etc.)

HOW is this story important?

PREDICT what you think might happen as this story develops. THINK!

ASK - Write a well-developed and thoughtful question that the class can answer from information on this page. It should **not** be a YES or NO question.

ANSWER – Write, in complete sentences, a thoughtful response to the question you wrote above.

CITE – Provide an MLA citation for this article (see attached reference sheet).

Please remember to attach article to worksheet.