

***The Triumph of Seeds- How Grains, Nuts, Kernels, Pulses, & Pips Conquered the Plant Kingdom and Shaped Human History* by Thor Hanson (2015)**

Included in this packet is a summary of each section of the book *The Triumph of Seeds*, interesting facts from the book, and discussion questions for your book club.

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Meets the following standards of the Pennsylvania Department of Education (grades 9-12):
Reading and Writing in Science and Technical Subjects

- CC.3.5 Reading Informational Text: Students read, understand, and respond to informational text – with emphasis on comprehension, making connections among ideas and between texts with focus on textual evidence

Career Education & Work

- 13.1 Career Awareness and Preparation



***The Triumph of Seeds* by Thor Hanson (2015)**

Seeds Nourish

Chapter 1 – “Seed for a Day”

Chapter 2 – “The Staff of Life”

Chapter 3 – “Sometimes You Feel Like a Nut”

There are hundreds of thousands of kinds of plants; each owing their beginnings to a seed. In “Seeds Nourish” Thor Hanson explores what makes seeds so successful.

The germination of seeds depends on what that plant needs (amount of sunlight, water, nutrients in the soil) in the particular environment in which it finds itself. Carol Baskin, a seed biologist at the University of Kentucky, says that seeds are “baby plants in a box with its lunch” (p.9). Seeds are portable, protected, and well nourished.

Hanson goes on to point out that the availability of grains seems to be tied to the success of early civilizations (p.23). Richard Wrangham, a professor of biological anthropology at Harvard, theorizes that many of the changes in humans over history is a result of a diet based on “gathering” rather than “hunting” (p. 27) Thus, seeds came to be our most important nutritional resource.

Hanson shows how the success of fracking today is closely tied to plants. And, he shows how that has led to a boom in the production and exportation of other grains (p.51).

Interesting Facts

- Most seeds take up water right before they germinate, thus making them heavier. (p.12)
- Grains have been key factors in founding nearly every early civilization – wheat, rice, corn, sorghum. (p.22)
- By the year 2000 the exportation of guar brought over \$280 million to India. (p.50)

Discussion Questions

1. What do you see as the relationship between the cultivation of seeds and the course of history?
2. After reading pages 26-32, do you agree or disagree with Richard Wrangham’s theory that a diet of grains was a major factor in human development and the strength of early civilizations?



3. “When harvests are poor, governments falter” (p.32). What evidence is there of this dependence on plants in today’s world? Do you see this currently happening in countries?
4. “When farmers in India realized that the guar-gum they had been growing for thousands of years was a very powerful thickener, their guar exports to the food industry soared (p.59). When frackers found that guar was a perfect substance to hold the fracking fluid together, prices for guar rose more than 1500% in only a few years. Does this alter your thoughts on fracking and its impact on the global economy?
5. On page 39, Hanson writes, “From the first crunch of the roasted almond to the chewy sweetness of the chocolate and coconut finish, savoring an Almond Joy is an entirely seed-based experience”. He goes on to write, “The seeds involved don’t just taste good; they demonstrate beautifully the incredible range of ways a plant can pack lunch for its offspring”. What other examples of entirely seed-based food experience can you think of?

Seeds Unite

Chapter 4 – “What the Spike Moss Knows”

Chapter 5 – “Mendel’s Spores”

Uniting all seeds is the “common goal of protecting, dispersing, and feeding baby plants” (p.17) Hanson discusses the qualities that seeds have had in common throughout Earth’s history, and their ability to adapt to a variety of climate changes (p.62-63).

The evolution of seed development took over 160 million years, starting with the spore bearing plants, followed by gymnosperms, which gave way to angiosperms. Bill DiMichele, curator of fossil plants at the Smithsonian Institute, theorizes that seed plants developed much earlier than originally thought (p.59-64).

Gregor Mendel’s research and findings about recessive and dominant inheritable traits went widely unnoticed and unappreciated for almost 40 years. When his paper was “rediscovered” it heavily influenced the field of modern genetics.

Interesting Facts

- With the advent of the covered seed, plants relied more on animals to pollinate. This caused the development of colorful petals, aromas, and sweet nectar. (p.68-69)



- Because spores don't "pack a lunch", they are not particularly useful to people for nutrition. (p.71)

Discussion Questions

1. How does DiMichele's theory of the early dominance of seed bearing plants during the Carboniferous period (p.60-63) alter your view of life during that time?
2. How might agriculture look different today if Mendel's research had not been "rediscovered"?
3. Spore bearing plants gave way, eventually, to angiosperms because of changes in the climate (p.63). These plants adapted in the changing environment to survive. How might our present day climate change affect plant and seed development in the future?

Seeds Endure

Chapter 6 – "Methuselah"

Chapter 7 – "Take It to the Bank"

The ability of seeds to remain dormant and still viable has a great positive impact on plant longevity and on global agriculture.

There are several examples of seeds germinating after decades and even over a hundred years. Seeds remain dormant until conditions are just right. (p.85-89)

The National Seed Bank (National Center for Genetic Resources Preservation) has a collection of more than 2 billion specimens. Seed banks can provide seeds for areas that have faced disasters, diseases, and loss of plant diversity. By "manipulating two critical storage factors, temperature and humidity" scientists have not only prolonged the "life" of seeds, but they have also applied these principles for use in everything from medicines to the space program (p.98-101).

Interesting Facts

- Methuselah, the Judaeen palm that germinated after close to 2000 years, makes it one of the oldest organisms on earth. (p.87)
- Seeds can have an almost indefinite life span if conditions are just right. (p.89)
- Medical researchers have recently mimicked the dry cool dormancy conditions of seeds to create stable dry vaccines for use in places that have no refrigeration. (p.100)



- Basil seeds successfully sprouted after spending more than a year on the International Space Station. (p.101)
- Seed banks are quickly growing in number due to the recognition of threats from declining crop diversity and loss of native plants. (p.104)

Discussion Questions

1. The Judean palm germinated after more than 2000 years (p.86-87). What are some implications of this discovery for seed banks?
2. With the advent of industrial agriculture (monoculture), plant diversity has become an issue. After reading the section “Seeds Endure”, what are some things you can do as a backyard gardener to protect and promote plant diversity? Do you think we all have a role in protecting and promoting plant diversity?
3. The diversity of crop varieties that have been grown in the past (heirloom varieties) has been largely abandoned for seeds that work well in an industrialized agriculture setting. How do we balance feeding the world’s population with the ecological benefits that seed diversity brings?
4. Christina Walters, supervisor at the National Center for Genetic Resources Preservation, says, “The best kind of conservation is in situ.” (p.106) Discuss the practice of growing plants in their natural habitat versus using a seed bank.

Seeds Defend

Chapter 8 – “By Tooth, Beak, and Gnaw”

Chapter 9 – “The Riches of Taste”

Chapter 10 – “The Cheeriest Beans”

Chapter 11 – “Death by Umbrella”

A plant’s primary job is to continue its species. To do so it must defend its seeds. Hanson explores the idea of “coevolution” – a change in one organism leads to a change in another (p. 115). To give the seed the best chance of germinating, some seeds have developed an almost impenetrable shell. Other seeds have developed toxins to prevent predators from consuming the seeds. In any case, plants/seeds must balance between protection from being eaten and still being dispersed. Many of these strategies have benefitted humans – from the tang of a spicy dish, to life saving pharmaceuticals, to a morning cup of coffee, to sweet smooth chocolate.



Interesting Facts

- One of the only pirate chests ever recovered from Captain William Kidd contained not gold or silver, but a few bolts of cloth and a bale of nutmeg and cloves. (p.132)
- The Dutch East India Company which traded spices, showed annual stock returns above 27% for 46 years! (p.132)
- Caffeine moves around inside a coffee tree, even into the nectar. In just the right dose, it keeps bees coming back, insuring pollination. (p.148)
- Today, almost 5% of all new drugs approved in the USA come directly from plants. (p.169)

Discussion Questions

1. Hanson's dissertation research involved the almendro tree seeds. Discuss the almendro tree's seed dispersal strategies and why they are so important for its survival? If you were to create a seed dispersal strategy for a plant, what would it look like? How would that serve the plant?
2. Think about the spices you have in your spice rack. Throughout history, world trade and economics have revolved around spices and seeds. Explorers journeyed to the ends of the earth to procure them. How has this influenced where we live and what we have in our spice racks today?
3. Plants use the caffeine in coffee plants, the poison in the castor bean, and the spiciness of a chili pepper to its benefit. How have humans benefitted from plant and seed defense strategies? What is the balancing act of plants that have toxic seeds? How have you been affected by some of these defense strategies?
4. "Excluding small, ineffective seed predators and limiting the damage from large ones requires a shell with just the right level of defenses, one that optimizes what ecologists call handling time" (p. 117). This suggests a balancing act for plants to protect their seeds while still needing them to be dispersed. Explain the coevolution between plant seeds and the animals who eat them.



Seeds Travel

- Chapter 12 – “Irresistible Flesh”
- Chapter 13 – “By Wind and Wave”
- Conclusion – “The Future of Seeds”

Seeds need to travel away from the parent plant for successful future plants. “In some cases, adults release toxins into nearby soil to prevent their progeny from becoming competitors” (p. 183). Plants use their fruits to attract animals who will disperse their seeds. Hanson notes that the timing of ripening fruits coincides with the need of the animals that will disperse their seeds (p. 188-189). The color, scent, and sweet taste of fruit all play a role in this process.

Throughout history, plants have adapted varied seed designs for their seeds to be spread by the wind and by water. Seeds that will be spread by wind are lightweight and designed to stay aloft, while seeds that will be spread by water need to be water resistant (Chapter 13).

As seeds are hybridized, often *triploid* plants are created. They are healthy, but infertile, meaning that their seeds are sterile. (p.212)

Seeds have created global economies, caused wars, and inspired many products and devices. “All the elaborate and remarkable features found in seeds – from nourishment to endurance to protection – will persist only so long as they benefit future generations” (p. 215).

Interesting Facts

- There is a gourmet coffee which sells for up to \$300 a pound. These coffee beans are extracted from the dung of the Asian palm civet. (p.190)
- Lockheed Martin manufactures a surveillance drone that moves based on the design of a maple seed. (p.243)

Discussion Questions

1. The need for seed dispersal has influenced the development of fruits. What evidence from the text is there that this is true?
2. What might the implications be if the only seed dispersal method was to merely drop from the parent plant?
3. Plants have a unique relationship with their seed dispersers. What effect could climate change, endangered animals, and urbanization have on these relationships?



4. Biomimicry is the science of using nature to solve human problems.

Ex. Burdocks – Velcro

Javan cucumber – Stealth Bomber

What are some ways plants and seeds have inspired scientists?

General Questions

1. After reading *The Triumph of Seeds*, how do you look at seeds differently now? With praise, fascination, curiosity?
2. Seeds and their products can be found from the beans in our coffee to the cotton in our clothes. Yet, despite their importance, seeds are often overlooked. How will you now be looking at the daily products you use differently?
3. Talk about specific passages in *The Triumph of Seeds* that struck you as significant, interesting, profound, amusing, illuminating, disturbing, or sad. What was memorable? Why?
4. Much attention is paid to protecting endangered animal species. There are many plant species that are also endangered. What can/should be done to protect them? What are some implications for us if these plants are lost forever?
5. What did you learn from this book that you didn't know before?
6. Would you have read this book if it hadn't been a Community Read selection? Why or why not? Would you recommend this book? Why or why not?

