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How to attract spiders in our farm & create a suitable environment for the spiders

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Introduction

Spiders—though technically arachnids rather than insects—are often overlooked as beneficial, they are very effective pest controllers. Since they are attracted to their prey by movement, they eat many live insects. Jumping spiders and wolf spiders (pictured) are especially good at keeping pests under control. Spiders are among the most neglected and least understood predators. They rely on a complex diet of prey and can have a strong stabilizing influence on them. Because spiders are generalists and tend to kill more prey than they consume, they limit their prey, initial bursts of growth.

Many spiders live in crop canopies but most inhabit the soil surface and climb plants. Fields with either living plants or residue as soil cover tend to harbour diverse and abundant spider populations. Up to 23 spider families have been documented in cotton and 18 species have been tailed in apples. Because such diverse populations of spiders remain relatively constant, they maintain tolerable levels of their associated prey without extinguishing them. Tip field with either living plants or residue as soil cover tends to harbour diverse and abundant spider's populations. Living mulches composed of clover or other soil-plant covers attract spiders, while residue from plants like barley or rye also harbours spider populations.

"For many years, people thought I was spraying at night.

They couldn't believe anyone could succeed without chemicals."

"Spiders are also farmer's friends"

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Wolf Spider

Orb-weaving spiders

Type of spiders

8 kinds of spiders eat small insects and help to improve soil health.

Earthworms are known to be a farmer's best friend in improving soil health. But the worms are not alone as several insects and spiders help farmers in their way. This included Long Jawed spider, wolf spider and dwarf spider.

Orb weavers Spider

My favourite orb-weavers are the striking black-and-yellow garden spiders. They are the large colourful spiders I often encounter while hiking in my hayfield. Orb weavers begin their sophisticated webs by establishing a bridge from one anchor to another. From a twig or grass stem, for example, the spider releases a strand of silk from its several pairs of silk-making organs called spinnerets. The breeze catches the strand and carries it until it touches another perch, and the bridge is formed. After strengthening the bridge by moving across it several times and laying down more layers of silk, the spider drops from a strand fastened to the centre of the bridge. It repeats this process several times in all directions until there are a series of spokes radiating outward from the central hub. Then the spider adds an outward spiral to complete the web.

Spiderweb

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Spider silk is strong, elastic, and sticky — perfect for snaring unwitting prey. Look closely at an orb weaver's web, and you may find a heavy zig-zag pattern near the centre of the web. This distinctive pattern reflects ultraviolet light. Some spider experts believe this is a lure that attracts unsuspecting insect prey. The rest of the web's spiral and radiating strands lack this quality. Prey is attracted to the UV reflection because many pollen and nectar laden flowers also reflect UV light. Insect pollinators can see UV light and are thus duped into investigating the web's reflectivity. After they land on the web, it's too late. They become entangled on the sticky invisible strands, and the vibrations caused by their thrashing alerts the web weaver that dinner is served. The spider then dashes out to the victim and subdues it using all of its eight legs (insects have six legs). It hangs onto the web with its first two pairs of legs, the third pair grabs the prey, and the fourth pair pulls silk from the spinnerets to wrap around the victim. When the prey is subdued, the spider bites it and injects an immobilizing venom. It then either eats the unfortunate victim or cuts the silken mummy from the web and stores it elsewhere to be eaten later.

Baby spiders

Soon female garden spiders will mate and lay hundreds of eggs in a papery egg sac that is attached to the edge of the web. After laying eggs, females die. The eggs hatch before winter arrives, but the spiderlings remain in the protective sac until spring. But not all spiders spin webs to capture prey. Only about 180 of the approximately 4,000 species of spiders that inhabit the U.S. are orb weavers.

Crab spiders

Brightly coloured crab spiders, for example, ambush their prey. Their enlarged forward-directed front four legs give them a crab-like appearance, and they hide among colourful flowers and wait for unsuspecting pollinators.

Wolf spiders

Wolf spiders are large, active predators that run down their prey. When not hunting, they rest under rocks or in burrows. Female wolf spiders carry their egg cases under their abdomen, and when the spiderlings hatch, they gather on their mother's back. If startled, the brood can

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scurry in all directions, giving the impression that a big spider magically transformed into many tiny ones.

Fishing spiders

And fishing spiders rest on bits of floating vegetation and detect vibrations on the water surface when insects fall in. The water serves as a substitute web. Other times, fishing spiders feed more actively. They may dangle their front legs in the water to lure a nearby aquatic insect or minnow.

Benefits of spiders and how to attract spiders to our farm

A new study explores how conservation agriculture in southern Africa supports spider populations and diversity in fields, which could help mitigate pest damage and potentially lead to higher yields for farmers. According to the Food and Agriculture Organization of the United Nations (FAO), herbivorous insects such as aphids, caterpillars and weevils destroy about one-fifth of the world's total crop production each year. Spiders can help keep voracious pests incheck, but conventional farming practices (e.g., tilling, crop residue removal and monoculture) can harm or drastically reduce these beneficial bio-control agents.

There are more than 45,000 identified spider species around the world. From glaciers to tropical rainforests, they inhabit every terrestrial ecosystem on earth. Some can even livein tidal zones, and at least one species inhabits freshwater. While we tend to associate spiders with webs, only about 50 per cent of the species catch their prey this way; the rest hunt on plants, on the ground or below it, using a variety of tactics such as stalking, stabbing, crushing – even seduction.

Although spiders have been around for 300 million years, some species are at risk of extinction due to habitat loss and fragmentation. Drastic reductions in vegetation – whether from a new parking lot or a tilled field – removes the food source that attracts their prey. Bare ground exposes their nesting sites and themselves, which makes it harder to hunt and easier to be hunted by birds and small mammals.

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At the Chinhoyi University of Technology experimental farm in Zimbabwe, a team of researchers aimed to determine the response of spiders under different agricultural practices. Conventional farmers often prepare their fields for planting by physically breaking up and inverting the top 6-10 inches of soil. This practice of ploughing prepares a fine soil tilth, which makes it easier to plant; it breaks up and buries weeds, and reduces soil compaction to aerate the soil. But tilling also increase topsoil erosion from wind and water. It accelerates soil carbon decomposition, reduces soil water infiltration and disrupts microorganisms living in the soil, including beneficial insects and spiders. The researchers conducted two experiments over the 2013/2014 and 2014/2015 cropping seasons to see how tilling, crop residue retention (i.e., leaving stalks and post-harvest organic matter in the field), fertilizer application and weeding affected ground- and plant-wandering spider species. They hypothesized that spider abundance and diversity would increase with lower levels of soil disturbance and more plant cover.

The results showed direct seeding into no-till soil increased the abundance of spiders and the diversity of species. Mulching also showed a positive effect. Contrary to their hypotheses and results from temperate regions, the application of fertilizer and intense weeding did not affect the spider community. The researchers attributed this to the difference in climatic conditions (tropical vs. temperate) of this study in southern Africa.

“Often the governments and farmers’ immediate reaction to a crop pest issue is to apply a pesticide, but we can make use of biological control agents, which may be cheaper and less damaging for the environment,” says Christian Thierfelder, a co-author of the study. Thierfelder is a cropping systems agronomist and conservation agriculture specialist with the International Maize and Wheat Improvement Centre (CIMMYT) with long-term experience in sustainable intensification.

“Spiders, ants and beetles all do a really good job with little or no cost to the farmer,” he adds. “For us, it’s quite fascinating to see simple agronomic practices to affect and control crop pests. This also provides new avenues of dealing with the fall armyworm, an invasive species which has devastated crops across the majority of sub-Saharan Africa countries.”

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Wolf spiders are members of the family Lycosidae. These spiders are often big, ranging in size from 5/64 inch to 1 ¼ inch (2 mm-35 mm), and hairy, which alarms some people, but they are primarily nuisance pests. Over 100 species of wolf spiders are found in the United States and Canada. Most wolf spiders are nocturnal although some do hunt during the morning.

Unlike most spiders, wolf spiders are solitary creatures that hunt without forming webs. They actively chase their prey on the ground or plant foliage using their fast-running ability at night.

Mulches from rolled or cut leaves and stems, cover crops, grass clippings and leaves at the base of shrubs are considered suitable habitats for providing shelter and food sources for attracting and maintaining a population of wolf spiders. It is a beneficial insect for Alfa alfa vegetable

Insectary Establishment and Maintenance

In addition to insectary establishment—including the cost of ground preparation, planting and maintenance for at least one year following establishment—equipment needs for installation and maintenance should be included as key considerations in designing the insectary. Another key factor is the weather. In designing the insectary, consider a flexible approach to adjust beneficial habitat according to weather variations. Include in the planting mixture diverse plant species that are tolerant to drought, heat and wet feet. Biological control is the use of natural enemies — usually called "beneficial insects" or "beneficial" — to reduce, prevent or delay outbreaks of insects, nematodes, weeds or plant diseases. Biological control agents can be introduced, or they can be attracted to the farming system through ecosystem design. Naturally occurring beneficial, at sufficient levels, can take a big bite out of your pest populations. To exploit them effectively, you must: 1) identify which beneficial organisms are present; 2) understand their biological cycles and resource requirements, and 3) change your management to enhance populations of beneficial.

Your system moves slowly toward a natural balance and your pest problems decrease."

— Zach Berkowitz, California vineyard consultant

Adaptation of spiders

The varieties of spiders living across the globe inhabit many different environments and have adapted to many pressures. Many of these are prey-related, while others are environmental. Spider adaptations have allowed these organisms to hunt, live and procreate to become successful predators.

Hunting Adaptations

All spiders are predatory creatures. As such, their variegated hunting practices are adapted to suit their particular environment and the organisms they feed on. For instance, most spiders use webs to hunt, but not all of them. Some use camouflage to hide on plants – flowers, often – and wait for unsuspecting prey to wander by before pouncing. Other spiders find prey underwater and are adapted to dive under the surface, where most spiders fear to tread. Still, others adopt behavioural adaptations suited to their environment, whether that is a cave, a tree or the underbrush.

Superfluous Eating

An article published in a 2001 issue of "Behavioural Ecology" examined an adaptation that involves spiders living in food-limited environments, or areas where there is a low population or availability of prey. In these areas, spiders exhibited an adaptive behaviour involving the superfluous killing of those prey. They capture much more prey than they require, consume some of them in a binge, and leave the rest either unconsumed or partially consumed. Spiders in areas where prey populations are high do not exhibit this behaviour and, in fact, rarely leave unfinished or half-consumed prey.

Defensive Webs

A 2003 article published in the journal, "Ecology Letters," posits three-dimensional spider webs are important adaptations for many spiders. Araneoid sheet web weavers, the types of spiders who adapted to weave three-dimensional webs rather than two-dimensional orb

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webs, are now the most widespread aerial spider groups. These webs are an adaption in two ways. First, they can capture prey more efficiently, leading to increased populations of spiders. Secondly, they act as a defensive measure, particularly against predators like mud dauber wasps. As an effective defensive tool, three-dimensional webs allowed for the diversification of araneoid sheet web weaver species.

Social Spiders and Prey

In tropical environments, spiders have adapted to living in various habitats defined by elevation. In a 2007 article published in the "Journal of Animal Ecology," researchers noted that social spiders tend to populate lowland tropical habitats, while congeneric subsocial species occurred at higher elevations and/or latitudes. One reason for this is the size of insects available at different levels. They tend to be larger in lowland habitats, which restrict social spiders to hunting at that level.

Don't kill that spider in your house. It's unlikely to bite you and is good for the environment.

I know it may be hard to persuade you, but let me try: Don't kill the next spider you see in your home.

Why? Because spiders are an important part of nature and our indoor ecosystem — as well as being fellow organisms in their own right. People like to think of their dwellings as safely insulated from the outside world, but many types of spiders can be found inside. Some are accidentally trapped, while others are short-term visitors. Some species even enjoy the great indoors, where they happily live out their lives and make more spiders. These arachnids are usually secretive, and almost all you meet are neither aggressive nor dangerous. And they may be providing such services as eating pests — some even eat other spiders.

My colleagues and I conducted a visual survey of 50 North Carolina homes to inventory just which arthropods live under our roofs. Every single house we visited was home to spiders. The most common species we encountered were cobweb spiders and cellar spiders.

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Both build webs where they lie in wait for prey to get caught. Cellar spiders sometimes leave their webs to hunt other spiders on their turf, mimicking prey to catch their cousins for dinner.

Although they are generalist predators, apt to eat anything they can catch, spiders regularly capture nuisance pests and even disease-carrying insects — for example, mosquitoes. There's even a species of jumping spider that prefers to eat blood-filled mosquitoes in African homes. So, killing a spider doesn't just cost the arachnid its life; it may take an important predator out of your home.

It's natural to fear spiders. They have lots of legs and almost all are venomous — though the majority of species have venom too weak to cause issues in humans if their fangs can pierce our skin at all. Even entomologists themselves can fall prey to arachnophobia. I know a few spider researchers who overcame their fear by observing and working with these fascinating creatures. If they can do it, so can you!

Spiders are not out to get you and prefer to avoid humans; we are much more dangerous to them than vice versa. Bites from spiders are extremely rare. Although there are a few medically important species such as widow spiders and recluses, even their bites are uncommon and rarely cause serious issues. If you truly can't stand that spider in your house, apartment, garage or wherever, instead of smashing it, try to capture it and release it outside. It'll find somewhere else to go, and both parties will be happier with the outcome.

But if you can stomach it, it's okay to have spiders in your home. It's normal. And frankly, even if you don't see them, they'll still be there. So, consider a live-and-let-live approach to the next spider you encounter.

Hypothesis -

The following hypotheses were tested:

(1) In terms of the habitat features we expected the number of species to increase with more structured vegetation, as it is well-known that vegetation height and density are important for spiders (e.g., Greenstone 1984). We did not expect the number of species to change withregular flooding

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events as floodplain habitatsdo not necessarily harbour more species but rather exhibit different species compositions and different diversity patterns (Lambeets*et al.* 2009)

al. 2009).

(2) According to Entling*et al.* (2007) and Lam-beets *et al.*(2008, 2009) we also expected the vegetation structure, soil moisture and regular flooding to alter the species composition of spiders.

(3) As regards the effect of the landscape composition, we expected the number of species to increase with an increasing proportion of forests around the study sites, as a consequence of the occurrence of forest specialists and generalist species in the grasslands (Usher *et al*. 1993). We also expected the number of species to the in- crease with the increasing proportion of grasslands around the study sites, as the Theory of island biogeography states that more isolated habitats retain fewer habitat specialist species than less isolated ones (e.g., Löve*et al.* 2006).

al. 2006).

(4) According to the above-mentioned hypotheses we expected both the proportion of forestsand grasslands to influence the species composition of spider assemblages.

Result-

We have studied about attracting/invite spiders in our farm field &How to create a suitable environment for the spiders, finally resulted in the spider is more useful for farmers, spider likely to be intake some insect minimises the insect's population and protect the farm to the harmful insects.

Reference –

Robin sweetserbeneficial insects in the garden May 4, 2021

Serena Josephine M "Spiders are also farmer's friend" September 23, 2016

Dr. GladisZinatihow to plant insectary strips and which plants to use Nov 27, 2018

Altieri, Miguel A., Clara I. Nicholls and Marlene Fritz Manage insects on your farm : a guide to ecological strategies. (Sustainable Agriculture Research and Education handbook series ; bk. 7) ISBN 1-888626-10-0

Scott Shalaway Meet some common spiders September 14, 2017

Mark Orwell Spider Adaptations November 22, 2019

Matt BertoneDon't kill that spider in your house. It's unlikely to bite you and is good for the environment. May 28, 2018.

Galle, R., Vesztergom, N. & Somogyi, T. (2011) Environmental conditions affecting spiders in grasslands at the lower reach of the River Tisza in Hungary. —*Entomol. Fennica*. 22: 29–38.