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Abundance of nutritious food
PQNK®
The science of natural farming

Deeper Understanding of PQNK – The Science of Natural Ecosystems for Production Agriculture

An esteemed professor at a leading U.S. university—a long-time associate and advocate of the System of Rice Intensification (SRI)—initially connected with us in 2008 during our pioneering trials of growing rice on raised beds in moist (rather than waterlogged) soil. While researching alternative methods, we discovered SRI and found that many of its principles aligned with our existing practices. We adopted SRI's recommended spacing (8" × 8") and shared our results internationally, forging a collaborative relationship.

However, during one of our exchanges, I noted that SRI, while beneficial, lacks a robust scientific foundation—a perspective he understandably questioned. This sparked a series of thought-provoking discussions, which we've included here to provide context for the deeper exploration of PQNK that follows.

PQNK—Production Agriculture through Natural Ecosystem Science—is not merely an alternative practice but a paradigm rooted in the self-sustaining principles that have governed thriving ecosystems for over 400 million years. This document traces our dialogue, the scientific distinctions between PQNK and conventional methods, and the evidence supporting our approach.
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The 1st email in this thread that I received:

NU **Norman** [redacted] Inbox - a...f@gmail.com 21 June 2025 at 5:42 PM
This sounds pretty grim
To: Asif Sharif

Dear Asif,
I had not been keeping track of the agroclimate in South Asia, but it looks like Pakistan is getting a triple whammy, an expression that you might have learned while in North Carolina. Dreadful, dreadful. Possibly if SRI and SCI crops show greater resilience, this could help to persuade farmers (and government) to get on board with SRI and SCI. If you put any pictures, text and numbers together on this, I will be glad to help polish as this could be a teachable moment, which could put at least a little silver lining on this huge black cloud!
I hope that you are keeping well,
Norman

My response:

Asif Sharif
Re: This sounds pretty grim
To: Norman [redacted]

Inbox - a...f@gmail.com 22 June 2025 at 2:14 PM
Details

Dear Norman,

After years of dedicated involvement in process development and on-ground testing by thousands of practicing farmers, we have concluded that SRI/SCI is not a comprehensive solution to the existing challenges—global warming, erratic climate events, water scarcity, soil degradation, rising production costs, and the declining nutritional density and diversity of our food.

Many entities advocate for regenerative agriculture under various names, yet none fully grasp the root causes or offer viable, practical solutions. Unfortunately, those who do understand are often influenced by input supply companies.

At this point, SRI/SCI can serve as a reference, but the name is irrelevant. Instead, we must promote a comprehensive solution already practiced by hundreds of thousands of farmers—a solution that is rapidly gaining traction and debunking myths perpetuated by interest groups for commercial gain.

We should focus not on names, fame, awards, or rewards, but on delivering real solutions. The fundamental additions needed in SRI/SCI are:

1. **No soil inundation with water**
2. **No-tillage practices**
3. **Soil covered with thick organic mulch**

Soil temperature is a key driver of warming—a problem that cannot be solved without organic mulch cover. Bare soil is **30°C warmer** than mulched soil.

It's time to reset the fundamental principles of SRI/SCI.

Regards, Asif Sharif

In response to the followup email, I wrote an email explaining the reasons for my such understanding, which is placed below:

Asif Sharif
Re: This sounds pretty grim
To: Norman [redacted]

Inbox - a...f@gmail.com 25 June 2025 at 4:28 PM
Details

Dear Norman,

I am not disputing the benefits that SRI has provided in alleviating poverty, particularly among smallholder farmers. However, we must view this within the broader context of human technological progression.

The Evolution of Agricultural Practices: Consider how humanity has progressed in transportation: we relied on our legs for millions of years, then domesticated animals and used horses as the fastest travel method. We subsequently invented bicycles, which substituted for animals, then advanced to motorbikes, cars, and ultimately aircraft. While recognizing the benefits of air travel, the majority still relies on land-based transportation due to accessibility and convenience. Each technological step was beneficial at the time of its introduction and served large populations well.

Similarly, SRI represented an improvement over conventional rice production systems. Traditionally, rice was cultivated in low-lying areas where water naturally gathered and inundated the soil. In irrigated areas, conventional practice involved breaking the inundation cycle to maintain moist soil conditions and promote better tillering.

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SRI's Development and Limitations: The $15 million funding transformed SRI into what we see today. However, as I have mentioned previously, SRI is not a science-based process—it is a modest improvement on existing practices, particularly for areas requiring irrigation. While I do not challenge the benefits SRI has provided to numerous farming communities, its fundamental steps lack scientific grounding.

The natural algorithms of soil fertility and vegetation form ecosystems where uplands support vegetation and lowlands support water and aquatic life forms. Rice and certain other plants adapted to survive in water-inundated soil conditions, leading us to believe this was the optimal growing method. However, if this were true, why does SRI recommend maintaining moist (not inundated) soil conditions to encourage tillering?

Nature has precisely designed each plant to achieve its optimal potential. Water serves as a mineral carrier, and plants absorb only what they transpire. If rice required more water, it would have evolved broader leaves and would be planted during periods of lower humidity, not during peak humidity seasons. A simple comparison demonstrates this: when examining two rice plants in the same field—one growing in inundated conditions and another on a raised border designed to facilitate irrigation—the plants on raised borders consistently produce more tillers.

Every drop of water that bypasses the root hairs not only represents waste but also damages plant potential, soil health, and soil microorganisms.

Research Independence and PQNK: From the beginning, I decided against accepting grants and donations from governments or financial institutions, including the World Bank and FAO. My concern was that funding comes with strings attached, limiting research freedom and practical adoption. I have been offered substantial sums for PQNK propagation, which I have refused.

The distinction between funded research and self-funded research is crucial. Most research receives financial support, with donors often selecting subjects and expecting results that favor their organizational objectives.

The Research-Funding Complex: A problematic intermediary system has emerged between donors and researchers or extension entities. Operators within this system actively seek sellable topics that are attractive to funders, deliberately building cases through strategic content creation. They employ credible and well-known writers, leverage prestigious publications, and organize compelling presentations to promote their chosen narratives. However, most of such data is not truly representative of ground realities.

This creates a cycle where research priorities are driven by funding appeal rather than genuine agricultural needs. The intermediaries craft attractive proposals using established names and platforms, but the resulting studies often lack the independence necessary for objective scientific inquiry. The data presented, while appearing credible due to the reputation of its sources, frequently fails to reflect the actual conditions and challenges faced by farmers in the field.

This approach has contributed to our current challenges: soil degradation, climate issues, increased production costs, reduced nutritional density in food, and poverty among farming communities.

Consider the current state of agriculture: farmers are abandoning the profession, being replaced by large corporations. Today's farmers are often those with limited alternative employment options.

The PQNK Solution: PQNK is reversing this trend. A significant number of young people from farming families are returning to agriculture and achieving remarkable success in producing high-quality food at low production costs.

The Critical Question: The fundamental question remains: Should we continue with incremental improvements on conventional practices, or should we adopt science-based production systems that address all current challenges?

Two major factors require urgent promotion:

1. Breaking the hardpan formed by mechanization, which has disrupted the natural water cycle
2. Maintaining optimal soil temperature, as current practices contribute to planetary warming

The choice between gradual improvement and transformative change will determine the future of sustainable agriculture and food security. We stand at a critical juncture similar to past agricultural transitions, where we must choose between augmenting agricultural practices that evolved over thousands of years without regard to natural ecosystems, or following the naturally designed production systems that have sustained life for over 400 million years without depleting resources or generating waste and pollution.

Regards, Asif Sharif

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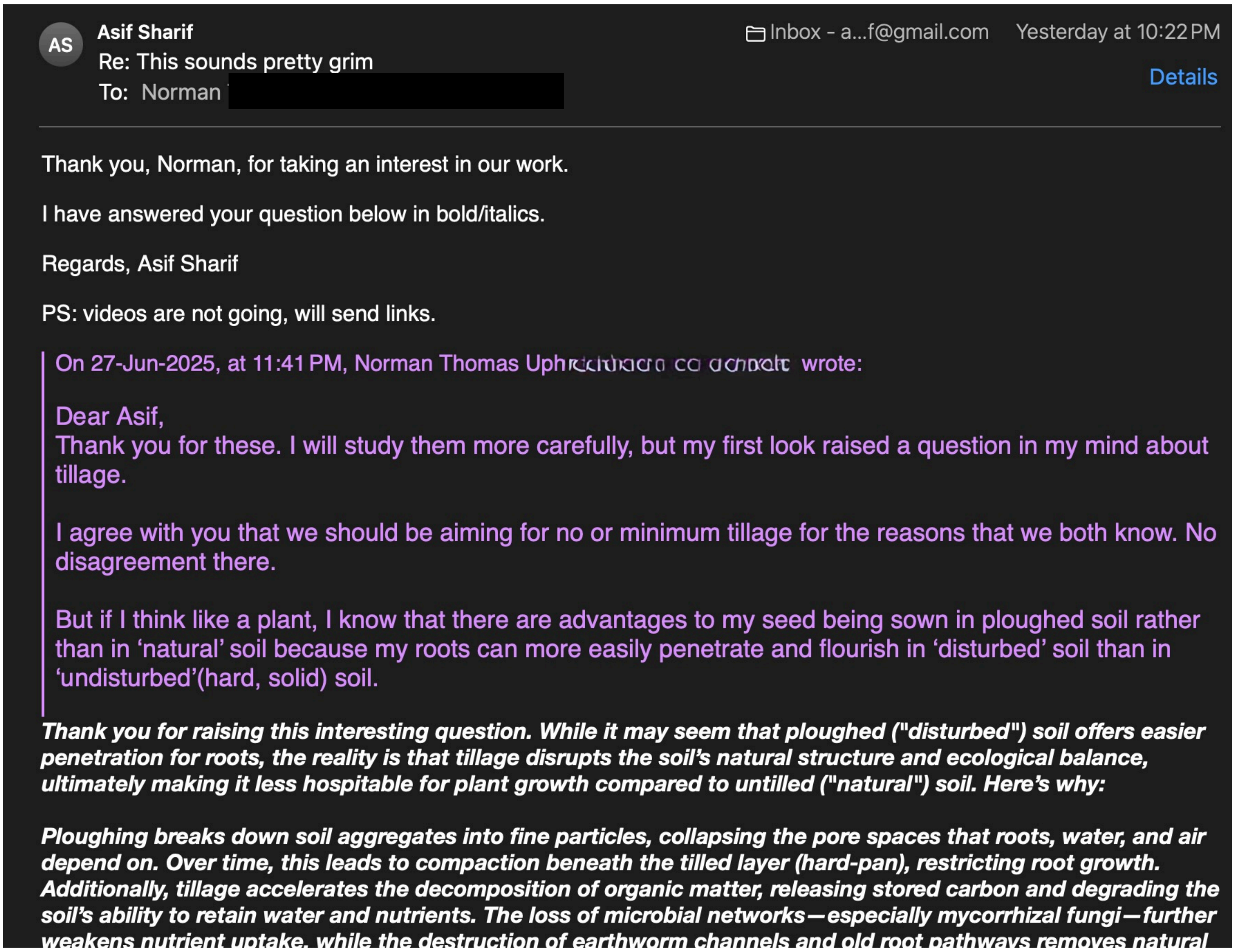
The final question answer in the email gets really interesting, placed below:



AS Asif Sharif
Re: This sounds pretty grim
To: Norman [redacted]

Inbox - a...f@gmail.com Yesterday at 10:22 PM

Details

Thank you, Norman, for taking an interest in our work.

I have answered your question below in bold/italics.

Regards, Asif Sharif

PS: videos are not going, will send links.

> On 27-Jun-2025, at 11:41 PM, Norman Thomas Uph[illegible] wrote:
>
> Dear Asif,
> Thank you for these. I will study them more carefully, but my first look raised a question in my mind about tillage.
>
> I agree with you that we should be aiming for no or minimum tillage for the reasons that we both know. No disagreement there.
>
> But if I think like a plant, I know that there are advantages to my seed being sown in ploughed soil rather than in 'natural' soil because my roots can more easily penetrate and flourish in 'disturbed' soil than in 'undisturbed'(hard, solid) soil.

Thank you for raising this interesting question. While it may seem that ploughed ("disturbed") soil offers easier penetration for roots, the reality is that tillage disrupts the soil's natural structure and ecological balance, ultimately making it less hospitable for plant growth compared to untilled ("natural") soil. Here's why:

Ploughing breaks down soil aggregates into fine particles, collapsing the pore spaces that roots, water, and air depend on. Over time, this leads to compaction beneath the tilled layer (hard-pan), restricting root growth. Additionally, tillage accelerates the decomposition of organic matter, releasing stored carbon and degrading the soil's ability to retain water and nutrients. The loss of microbial networks—especially mycorrhizal fungi—further weakens nutrient uptake, while the destruction of earthworm channels and old root pathways removes natural

Full text, my answers are in **Bold/*Italic***:

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Moreover, bare, tilled soil is prone to extreme temperature fluctuations, often exceeding 70°C in warm climates, which burns organic matter and kills beneficial soil life. Without protective cover, water evaporates rapidly, drawing up salts and increasing surface salinity. The disrupted soil structure also reduces water infiltration, leading to runoff and erosion. In contrast, undisturbed soil—rich in organic matter and microbial activity—remains well-aerated, retains moisture efficiently, and provides a balanced, sustainable nutrient supply.

While ploughing may offer short-term ease of planting, its long-term effects—loss of fertility, increased erosion, and reduced biodiversity—make natural, minimally disturbed soil far more conducive to healthy plant growth. Sustainable practices like no-till farming, mulching, and cover cropping preserve these benefits while still ensuring productive agriculture.

It needs to be taken into account that disturbed soil also makes it easier for the roots of 'weeds' (other plants) to grow. But that does not change the fact that untilled soil is not as hospitable germination and root growth.

You raise an excellent point about weeds thriving in disturbed soil, but their presence is not a flaw—it's a function. Weeds are often mislabeled as foes when, in reality, they are ecological allies. They emerge where soil is degraded—bare, compacted, or lacking microbial life—to perform vital restorative work: their roots break up hardened soil, rebuild pore spaces, and regulate temperature by shading the ground.

Conventional systems see weeds as competitors because they assume a finite pool of synthetic fertilizers must be rationed. But in natural systems (PQNK), where microbes—not chemicals—mediate nutrient cycling, the dynamic shifts. Soil microbes unlock minerals from organic matter and rock particles, converting them into plant-available forms in balanced proportions. In this context, weeds aren't "stealing" resources; they're co-participants in a system where all plants—crops and weeds alike—access what they need without scarcity.

Tillage and herbicides might suppress weeds temporarily, but they exacerbate the very conditions that invite weed colonization: soil collapse, biodiversity loss, and microbial starvation. Untilled soil, rich in organic matter and microbial networks, naturally regulates plant communities, reducing the need for intervention. Over time, as soil health improves, weed pressure often declines because the ecosystem no longer requires "pioneer" plants to mend its wounds.

I've attached a video and slide that illustrate this process visually—how weeds act as soil's healing agents and how no-till systems harness their benefits while minimizing disruption.

If the 'natural' soil is truly 'organicized' with a lot of life in it, it will be friable and have a lot of channels through which water and air (O2) can penetrate to lower horizons, and undesirable gases like H2S can be vented (evacuated). Lots of earthworms make for lots of channels, but other arthropods and invertebrates also work the soil to make it penetrable for roots as well as for water and air.

You're absolutely right—a truly "organicized" natural soil, teeming with biological activity, becomes self-structuring and optimally porous. Earthworms are indeed the most visible engineers, creating macropores that enhance drainage, aeration, and root penetration. However, they're just one part of a much larger ecosystem at work:

- ***Fungal Networks: Mycorrhizal hyphae bind soil particles into stable aggregates while creating micro-channels for water and nutrient flow.***
- ***Arthropods & Microfauna: Mites, springtails, and beetles mechanically break down organic matter, while their burrowing complements earthworm channels.***
- ***Root Systems: Living and decaying roots (from crops and weeds alike) leave behind biopores that act as highways for future roots, gases, and water.***
- ***Microbial Activity: Bacteria secrete glues (like glomalin from fungi) that stabilize aggregates, preventing compaction even under pressure.***

This biological web ensures that oxygen reaches deep layers, toxic gases (e.g., H_2S) diffuse out, and water infiltrates rather than pools—eliminating the need for mechanical tillage. Crucially, such soils resist compaction because their structure is dynamic: as old pores collapse, new ones are formed by ongoing biological activity.

The contrast with tilled soils is stark: tillage provides short-term friability by brute force, but at the cost of destroying the very organisms that maintain porosity naturally. Over time, this leads to dependency on repeated

disturbance. In contrast, nurturing soil life creates a self-renewing system where friability, aeration, and drainage persist without intervention.

My question is perhaps a small one, but I think that there are a lot of soils that even in natural conditions are pretty compacted, to an extent that ploughing is beneficial for plant growth – but weeds as well as crops. Ploughing can also contribute to compaction, certainly with heavy machinery.

Your observation about naturally compacted soils is important—yes, some ecosystems (like low-lying areas with poor drainage) develop extreme hardness due to salt accumulation and organic matter depletion. When rainwater runs off into these zones, it carries dissolved salts; evaporation then concentrates them at the surface, choking soil pores, raising pH, and creating a hostile environment where only a few resilient weeds survive. However, while ploughing might temporarily fracture such compacted layers, it's a short-term fix with long-term costs: it accelerates organic matter loss, exacerbates salinity by bringing deeper salts upward, and—as you noted—heavy machinery worsens subsoil compaction.
PQNK's regenerative approach addresses the root causes without relying on tillage:

1. ***Land Leveling & Hardpan Breaking: Laser-leveling ensures even water distribution, while subsoiling (a one-time mechanical intervention) breaks the hardpan without inverting layers.***
2. ***Salinity Flushing: Adding diluted sulfuric acid (10 kg/ac) neutralizes and solubilizes salts, which is applied with irrigation to leach down salts.***
3. ***Permanent Raised Beds: Elevating beds prevents waterlogging, while their undisturbed structure encourages root and microbial activity.***
4. ***Cover Crops & Mulch: Fast-growing covers (e.g., sunn hemp, Junter) rebuild organic matter, and their retained roots create biopores. Aboveground biomass acts as mulch, regulating temperature and moisture.***

The result isn't just short-term friability—it's a lasting recovery. We've regenerated barren fields where salts once crusted the surface into productive soils teeming with life, all without recurring tillage. The key is working with biology: roots and microbes maintain porosity, while mulch buffers against re-compaction.

This comes back to soil physics and biology, which have been eclipsed by the preoccupation with soil chemistry, looking only at the supply of nutrients rather than the FLOW of nutrients.

You've pinpointed the critical issue: modern agriculture's overemphasis on soil chemistry—reducing fertility to mere nutrient supply—has obscured the deeper roles of soil physics (structure, porosity, water dynamics) and biology (microbial mediation, nutrient cycling).

In PQNK, we flip this paradigm:

- ***Biology Replaces Chemistry: Instead of force-feeding soluble fertilizers, we nurture microbial communities that regulate nutrient flow. Fungi and bacteria convert minerals from organic matter and rock particles into plant-available forms as needed, preventing leaching and imbalance.***
- ***Physics Enables Flow: Healthy soil structure (maintained by roots, fungi, and earthworms) ensures oxygen, water, and nutrients move efficiently to roots—no chemical surplus required.***

Attached is a slide illustrating how just of total soil minerals (in sustainable forms) can meet crop demands when biology orchestrates their release. Compare this to conventional systems, where 90% of applied NPK is lost to runoff or volatilization!

The takeaway? Soil isn't a passive warehouse of nutrients—it's a living, self-regulating system. By prioritizing biology and physics, PQNK achieves resilient fertility without chemistry's dead ends.

Anyway, I put this before you to work in more consideration of soil physics and biology to 'unpack' the issue of tillage.

Thank you for this thoughtful guidance—we fully agree that the tillage debate cannot be resolved without rigorously "unpacking" the interplay of soil physics and biology.

To confirm: we've done exactly this homework—deeply and systematically. Over the past 17 years, PQNK's protocols have been stress-tested across thousands of acres under radically diverse conditions:

- ***Topography: From floodplains to sloping fields, observing how biological systems manage water without tillage-induced erosion.***
- ***Soil Types: Clay-heavy compacted soils, sandy low-CEC soils, and saline wastelands—all regenerated through physics-biology synergies.***
- ***Crops: Annual cereals, perennials, and horticultural crops, tracking root adaptation to undisturbed soil structures.***

The results consistently show:

1. ***Physics in Action: Fungal hyphae and root networks replace tillage by creating stable macropores (0.5–2 mm diameter), achieving optimal bulk density (1.1–1.3 g/cm³) without mechanical loosening.***
2. ***Biological Pumps: Mycorrhizae extend root reach 100x, accessing deep nutrients and water—proven via isotopic tracing (attached data).***

3. ***Scaled Success: Yields match or exceed conventional tillage within its few crops, with almost zero input costs.***

I am fully on board with CA (esp. if one is ceasing flooding of soil, which fills up channels in the soil water, expelling air in the soil, and changing the structure of soil, its aggregation and aeration.

All the best,
Norman
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In this exchange, Professor Norman raised profoundly insightful questions—the kind only deeply knowledgeable minds can articulate. His challenges compelled us to articulate PQNK's principles with even greater rigor, for which we are sincerely grateful.
This dialogue underscores a critical truth: PQNK is not merely a farming method, but the reactivation of Earth's original operating system—a proven biological framework that has sustained over 1.5 million lifeforms across 400 million years. Today, we've translated this ancient wisdom into scalable science, validated across diverse soils and climates.

To farmers and scientists reading this: you stand at a threshold. Understanding these principles means joining a paradigm shift—from battling nature to collaborating with it. The results speak for themselves; the opportunity is now yours to test and witness.

Sincere regards,

Asif Sharif
Founder Chairman - Pedaver and the PQNK Initiative
pedaver@Gmail.Com

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