

PQNK Knowledge Paper: The Management of Soil Density within the Closed-Loop Regenerative System

Subject: Principles and Practices for Achieving Optimal Soil Physical Health

Conventional to PQNK - 4 easy steps

Prepare field for the type of irrigation



Break the hardpan



Make permanent raised beds



Plant crop after crop on permanent beds



1.0 Preamble: The PQNK Philosophy on Soil

Paedar Qudratti Nizam Kashatqari (PQNK) is a regenerative and sustainable Pristine Organic Farming System. It operates on the fundamental principle of a strictly closed-loop ecosystem. Nothing is added from outside the farm boundary after the initial transition. The system's vitality is driven by in-situ biological processes, self-generated organic matter, and the strategic sequencing of deep-rooted pioneer plants. This knowledge paper outlines the PQNK protocol for managing the critical physical property of soil density, which is foundational to crop root health, water dynamics, and overall system resilience.

2.0 Understanding Soil Density in the PQNK Context

In PQNK, soil is recognized not as an inert growing medium, but as a living, breathing ecosystem. Soil density provides a physical measure of the

compactness or porosity of this living matrix, directly determining its capacity to support life.

- **2.1 Particle Density:** This refers to the density of the solid soil particles alone (minerals and stable organic matter), excluding the pore spaces between them. It typically ranges from 2.6 to 2.75 g/cm³ and is relatively stable. PQNK does not focus on altering this metric directly. Instead, the system ensures these particles consist of a balanced, biologically-cycled blend of minerals and humified organic matter, achieved entirely through on-farm processes.
- **2.2 Bulk Density:** This is the operationally critical measure for the farmer. It is the mass of dry soil including its pore spaces per unit volume. It is the definitive indicator of soil compaction, root zone aeration, and water movement. Managing bulk density biologically is a primary focus of the PQNK methodology.

3.0 PQNK's Ideal Soil Physical State

The PQNK system is designed to create a soil that is loose, well-aggregated, and biologically active—structurally akin to a sponge cake. This state ensures optimal movement of air, water, and roots.

- **3.1 Ideal Bulk Density Range:** For most field crops (grains, vegetables, pulses), the target bulk density range for a loamy PQNK soil is between 1.0 to 1.3 g/cm³.
- **Below 1.0 g/cm³:** May indicate exceptionally high organic matter content, which is generally favorable for root growth.
- **Above 1.4 g/cm³:** Indicates the onset of compaction, where root growth for sensitive crops (e.g., carrots, tomatoes) becomes restricted.
- **Above 1.6 g/cm³:** Signifies severe compaction, creating a physical barrier that the roots of most crops cannot effectively penetrate.
- **3.2 Ideal Particle Density:** A mature PQNK soil, enriched through years of in-situ organic matter cycling, will typically exhibit a particle density around 2.65 g/cm³. The significance lies not in the number itself, but in the origin and composition of those particles—a biologically-fabricated complex of minerals, silica, and stable humus.

4.0 The PQNK 4-Step Transitional Method to Permanently Correct Soil Density

PQNK prescribes a singular, non-repetitive transitional sequence to permanently remediate compacted soil and achieve the ideal physical state. This process is mandatory for system establishment.

Step 1: Break the Hardpan

A one-time mechanical intervention is permitted. A subsoiler (not a plough) is used to shatter the subsurface compacted layer (hardpan). This initial fracture enables

the deep percolation of water and allows the entry of pioneer plant roots, setting the stage for biological takeover.

Step 2: Correct Soil Chemistry with Water and Acid (Conditional)

This step is activated only if the soil pH is tested and found to be above 8.0, indicating salt and mineral lock-up. A single, deep irrigation event is applied to leach soluble salts. In conjunction, 8 kg of sulfuric acid per acre is applied with this water. This one-time chemical correction within the closed-loop system actively lowers pH, liberates locked nutrients, and creates a soil environment hostile to parasitic weeds. If pH is below 8, proceed directly to Step 3.

Step 3: Build Permanent Raised Beds and Plant Jantar

Permanent raised beds are constructed immediately. On these beds, a dense stand of Jantar (*Sesbania aculeata*) is sown. The powerful, deep-penetrating taproot system of Jantar is PQNK's primary biological tool for permanently shattering subsoil compaction, creating stable bio-pores, and drawing subsurface minerals into the biomass. All inputs for this process are generated on the field.

Step 4: Retain, Mulch, and Plant with No-Till

At the flowering stage, the Jantar biomass is chopped and left as a thick mulch layer on the same bed. Its root system is left in-situ to decompose. This establishes the first permanent, spongy organic horizon. Henceforth, all ploughing is strictly prohibited. Every subsequent cash crop is sown directly into this mulch using a no-till planter. All crop residues from every cycle are retained as mulch on the same beds, perpetually enhancing soil porosity and lowering bulk density through biological activity.

5.0 Core PQNK Operational Principles for Sustaining Ideal Soil Density

- **Principle of In-Situ Resource Generation:** No external inputs—including FYM, vermicompost, bio-preparations (Jeevamrit, Ghanjeevamrit), or mineral amendments (rock dust, lime)—are permitted. Soil organic matter is solely the self-generated mulch from Jantar and successive crop residues.
- **Principle of Permanent Soil Armor:** The soil surface must never be exposed. A permanent mulch blanket, created from on-farm plant biomass, protects against crusting, compaction from raindrop impact, and moisture loss.
- **Principle of Zero Soil Disturbance:** After the one-time subsoiling in Step 1, the only tool permitted to interact with the soil is the no-till planter for seeding. This preserves the fungal networks and soil structure created by biology.
- **Principle of Biological Mineral Cycling:** No external mineral balancing is allowed. Nutrient availability is managed through the closed-loop cycle: deep-rooted plants (Jantar) mobilize subsoil minerals, and the continuous return of all plant residues to the same soil maintains the nutrient equilibrium.

- **Principle of Autonomous Water Management:** Irrigation systems (drip, flood) are not used. Soil moisture is regulated by the permanent mulch layer, which captures rainwater, dew, and atmospheric humidity. The biologically-improved soil structure maximizes infiltration and water-holding capacity. Furrow irrigation along the raised bed pathways is an extremely rare measure for dire emergencies only.

6.0 Impact on Crop Production

Adherence to this protocol transforms the soil into a resilient, low-bulk-density ecosystem:

- **Unrestricted Root Exploration:** Deep, stable bio-pores allow crop roots to access deep water and nutrients, building robust, stress-resistant plants.
- **Optimized Water Dynamics:** The soil acts as an effective reservoir, minimizing water dependency and maximizing rain-use efficiency.
- **Vibrant Aerobic Habitat:** Continuous pore space supports a thriving aerobic soil food web, essential for nutrient cycling and disease suppression.
- **Self-Renewing Fertility:** The in-situ cycle of growth, mulching, and decomposition perpetually liberates and recycles all necessary nutrients for sustained production.

7.0 Conclusion

PQNK provides a definitive, science-based, and closed-loop pathway to correct and maintain ideal soil density. By transitioning through the non-negotiable Four Steps and adhering to its core principles, the farmer creates a self-sustaining, porous soil ecosystem. This system produces abundant yields through intrinsic biological processes, freeing the farmer from external inputs and building lasting agricultural resilience.

***Footnote:** PQNK (pronounced 'picnic')—the regenerative & sustainable Pristine Organic Farming System—is grounded in Natural Ecosystem Science. This science employs perennial biodiversity, protects soil with organic mulch, and avoids practices like water inundation, tillage disturbance, and leaving soil bare.*

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