Linkage between sediment induced spatial variability in soil characteristics and rice performance in paddy fields in mountainous regions of Vietnam

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Population pressure and economical changes

Deforestation

Land use intensification: maize + cassava

Erosion + runoff

Lowland rice

=> Impact on soil fertility in upland and lowland
Hypothesis:

- sediment concentration = f(rainfall intensity, duration; ground cover; water flow; travel distance, ...)
  ⇒ unequal distribution among paddy fields

- sedimentation = source for plant available nutrients
  ⇒ spatial variability of crop performance due to unequal distribution of sediments?
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Study area

Son La Province

Coordinates: 20°37’N; 106°4’E
⇒ tropical monsoon (1114mm, 24°C)
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**Field setup**

- 4 cascades
- *O. sativa*: sticky rice var. Nep 87
- fertilizer vs. no fertilizer
- soil samples: topsoil (0-5cm)
- crop performance measured at 7 points in the field

![Diagram of field setup with irrigation channel, fertilizer, and no fertilizer areas.]
Spatial variability of soil characteristics

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Organic carbon content (%)

Distance from the irrigation channel (m)

Distance from the inlet of a field (m)

Irrigation channel

Outlet

Inlet
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Spatial variability of crop performance

Maximum Tillering

Maximum Tillering - Panicle initiation

Flowering

Harvest
Spatial variability of crop performance

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Spatial variability of crop performance

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Inlet

Outlet

Irrigation channel

Distance from the irrigation channel (m)

Distance from the inlet of a field (m)

LAI - Maximum tillering/panicle initiation stage

LAI - value

0 1 2 3 4 5 6

Graph showing spatial variability of crop performance with LAI values.
Spatial variability of crop performance

- Distance from the inlet of a field (m)
- Distance from the irrigation channel (m)

Legend:
- LAI - value
  - 0
  - 1
  - 2
  - 3
  - 4
  - 5
  - 6
Spatial variability of grain yield (kg/m²)

-Irrigation channel

-Spatial variability of grain yield (kg/m²) from the irrigation channel (m) and distance from the inlet of a field (m).

-Grain yield (kg/m²) - non fertilized

-LAI value - flowering
Impact of distance to the irrigation channel on:

- Grain yield (kg/m²) shows the same trend
- Specific surface area = f(clay, silt, sand)

Increase of SSA (m²/g) towards the middle of the cascade
Grain yield (kg/m²) shows the same trend
Specific surface area (SSA) = soil fertility indicator?

⇒ Distribution of mineral soil fraction influences soil organic carbon and total nitrogen content.
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Grain yield (kg/m²) vs. Relative grain yield (%)

![Diagram showing grain yield and relative grain yield with a color gradient representing different values. The diagram includes labels for distance from the inlet of a field (m) and distance from the irrigation channel (m).]
Conclusion

• mineral soil fraction and grain yield = f(distance)
• $C_{org}$ and TN = f(SSA)
⇒ mineral soil fraction is partially influencing spatial variability of grain yield
• findings can be used for point specific fertilizer recommendations
⇒ reduces investment costs
Thank you for your attention!