Fall Cabbage And Silage Corn Responses To P And K Fertilization Rate In CT

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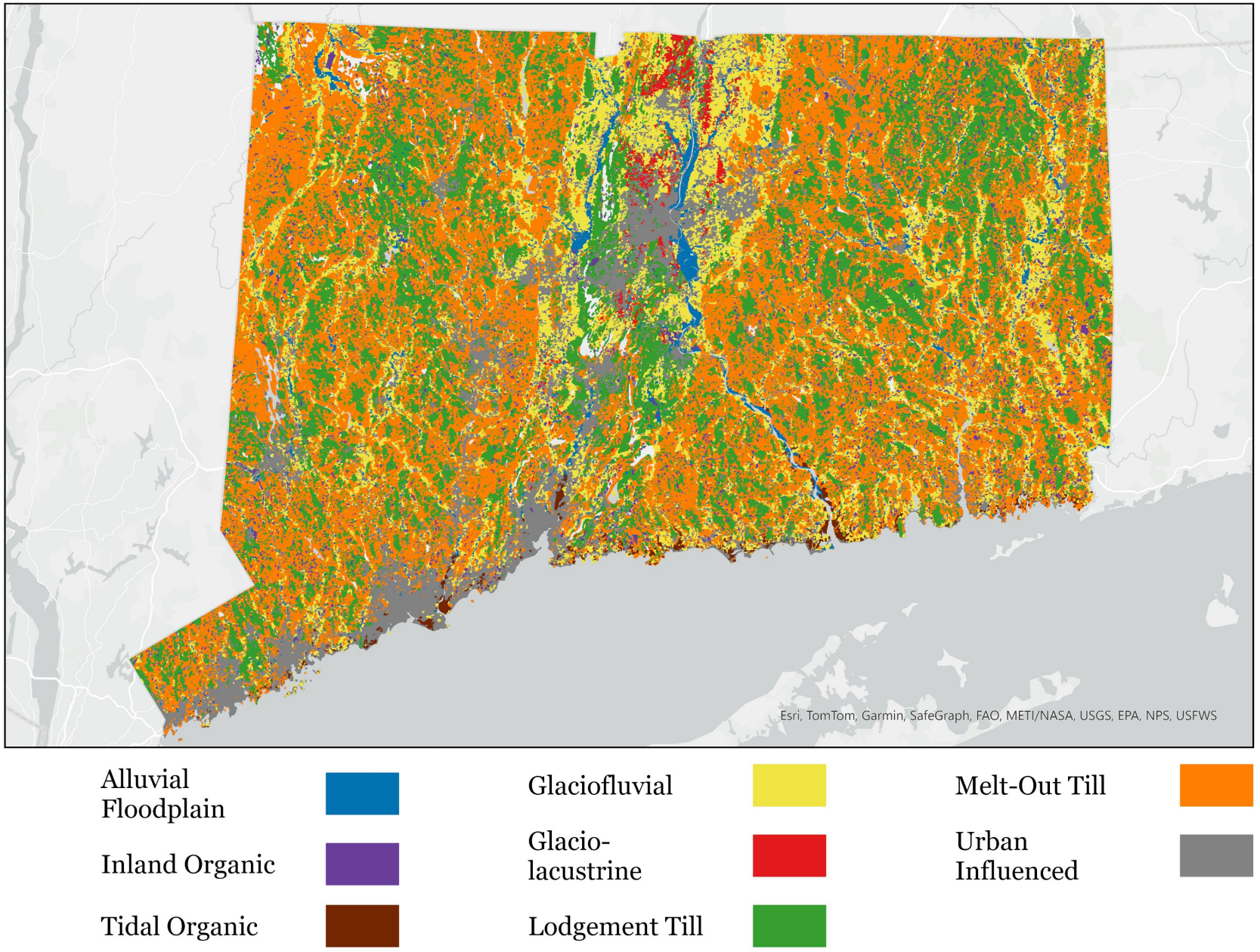
Entire state was once glaciated.

predominantly melt-out till, lodgment till, and glaciofluvial.

Soil forming processes began 15,000 yr at the end of the last interglacial period after the retreat of Pleistocene-epoch glaciers.



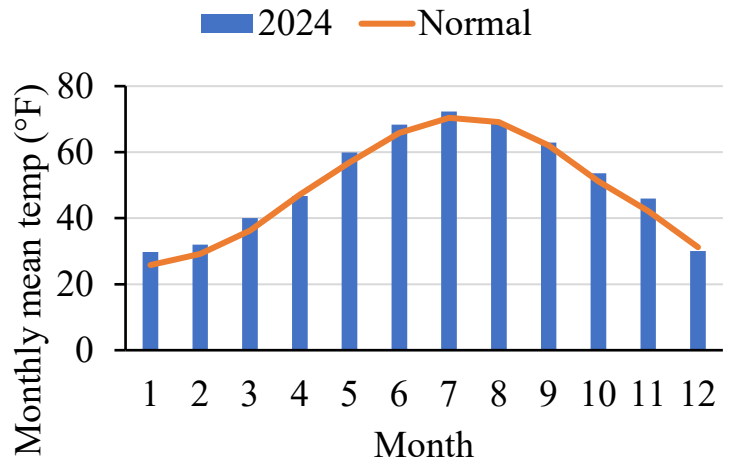
Soil Order	Soil Series	Drainage Class	Parent Material	Surface Texture	pH
Inceptisol	Paxton	Well	Glacial Till	Sandy Loam	5.5
Inceptisol	Ridgebury	Poorly	Glacial Till	Sandy Loam	5.5
Inceptisol	Charlton-Chatfield	Well-Drained	Glacial Till	Sandy Loam	5.5
Inceptisol	Canton	Well-Drained	Glacial Till	Sandy Loam	4.5
Inceptisol	Woodbridge	Moderately-Well	Glacial Till	Sandy Loam	5.2
Entisol	Hinckley	Excessively	Glaciofluvial	Loamy Sand	5.5
Inceptisol	Pootatuck	Moderately-Well	Alluvial sediments	Sandy Loam	5.5
Inceptisol	Merrimac	Somewhat Excessively	Glaciofluvial	Sandy Loam	5.1
Inceptisol	Agawam	Well	Glaciofluvial	Sandy Loam	5.4
Inceptisol	Enfield	Well	Glaciofluvial	Silt Loam	5.5
Inceptisol	Ninigret	Moderately-Well	Glaciofluvial	Sandy Loam	5.3
Entisol	Windsor	Excessively	Glaciofluvial	Loamy Sand	5.5

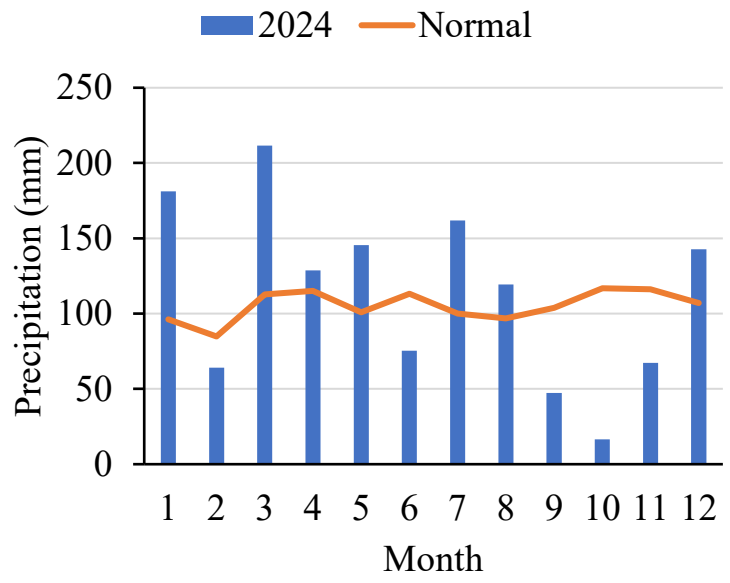
- **Many CT soils are very young and weakly developed, and many are relatively low in clays.**
- **Typically have sandy textures, large coarse fragments, and soils less than 3ft deep.**
- **Drumlins have highly compacted and poorly developed subsurface with limited water-infiltration, causing perched water tables.**

- **Research site:** Storrs, CT.

- **Four experiments:**
  - **cabbage-P**
  - **cabbage-K**
  - **corn-P**
  - **corn-K**

- **Soil Type:**
  - Cabbage P & K sites: Woodbridge fine sandy loam with 9%, 30%, 61% clay, silt, sand.
  - Corn – P site: Paxton and Montauk fine sandy loam with 11%, 28%, 61% clay, silt, sand.
  - Corn – K site: Woodbridge fine sandy loam with 11%, 30%, 59% clay, silt, sand.





- **Experimental design:** RCBD with 5 treatments & 4 replications

  P rate: 0, 56, 112, 168, 224 kg P_2O_5/ hectare

  K rate: 0, 56, 112, 168, 224 kg K_2O/ hectare

- **Variety:** Cabbage: 'White Mist F1 Hybrid'

  Silage Corn: 'Red Tail'

- **Soil Data Collected:** SOM, Total CN, Aggregate Stability, CO_2 Respiration, Particle Size, Nutrient Analysis – MM and M-3

- **Crop Data Collected**:

  cabbage: yield, head weight, leaf weight, sample dry head weight, sample dry leaf weight, tissue nutrient analysis

  silage corn: yield, ear weight, stem weight, sample dry ear weight, sample dry stem weight, tissue nutrient analysis

Baseline soil test results (average of four blocks) in the four research sites.

	P	K	Ca	Mg	Al	S	Fe	CEC	SOM	pH
Site	---------- mg kg^{-1} ----------							- meq $100g^{-1}$ -	- % -	
Cabbage-P	<1	77	342	61	155	26	2.7	7.4	4.3	5.4
Cabbage-K	<1	69	359	67.0	148	19.0	1.9	7.0	4.7	5.4
Corn-P	2.5	127	500	83	86	14.9	1.9	9.0	4.8	5.4
Corn-K										

Note: Nutrients: MM; SOM: LOI; pH: 1:1

CT Recommendations

Rating	**P**	**K**
Below Optimum	0-13	0-249
Optimum	14-20	250-349
Above Optimum	21-35+	350-500+

Fall cabbage - P

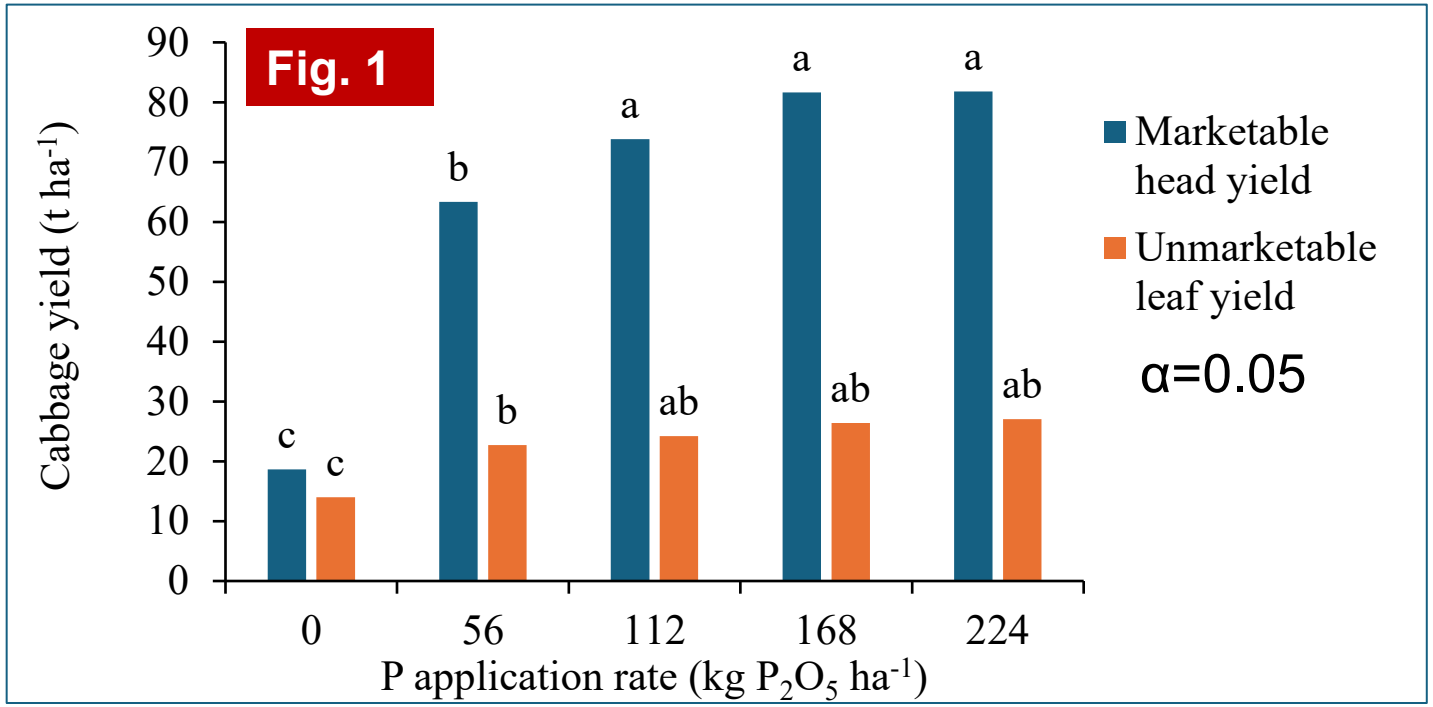
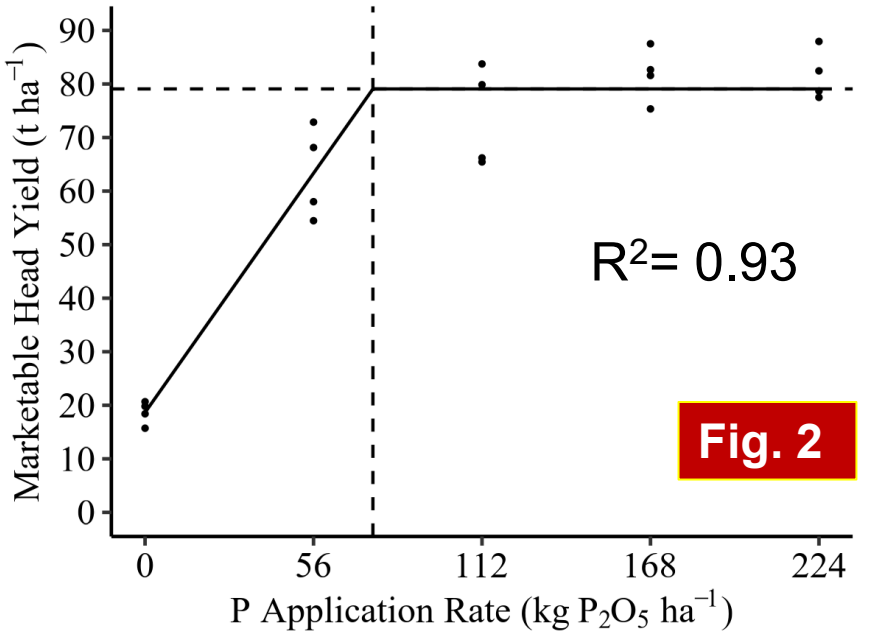
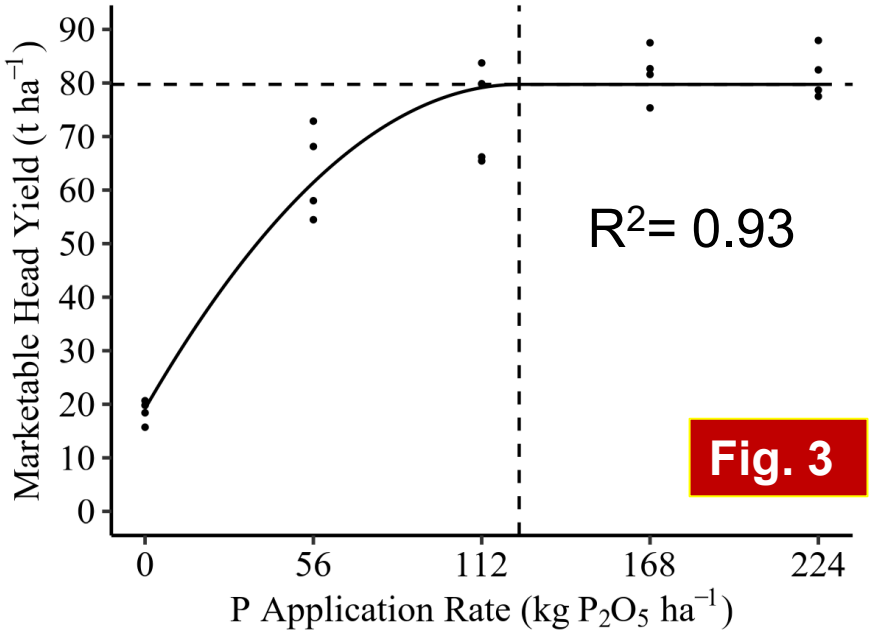


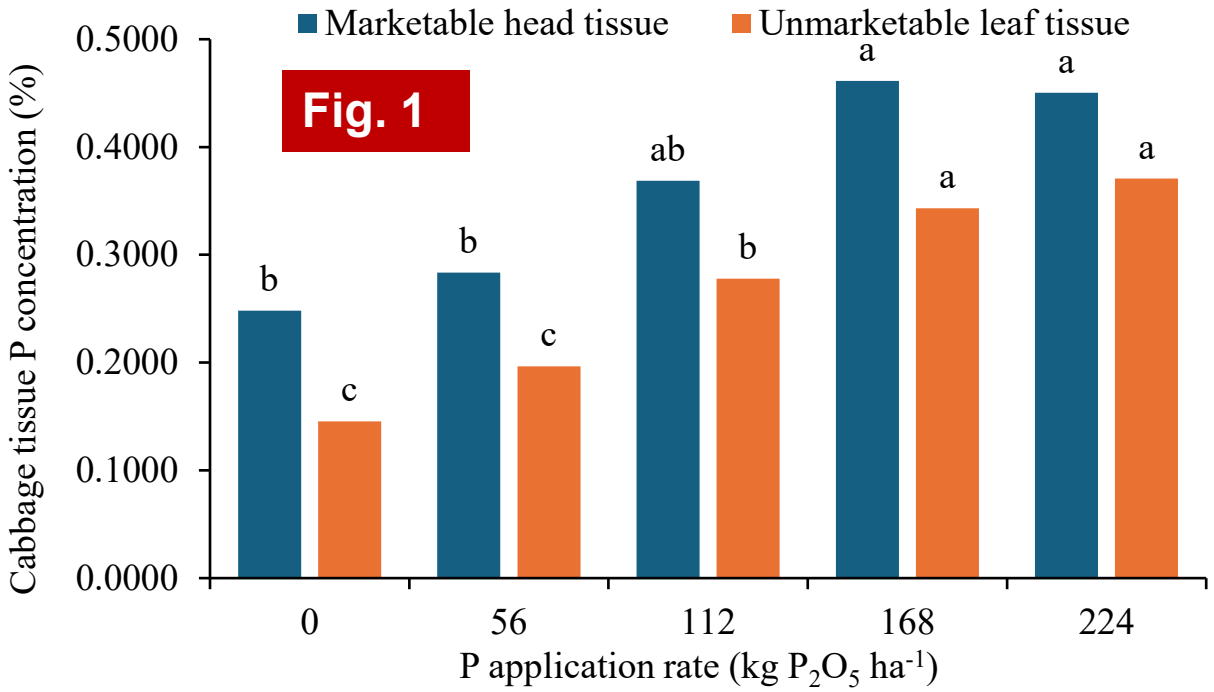
Fig. 1. Application of P resulted in significant higher mean yield of the both marketable head and unmarketable leaf compared with control.

Application rates of 112-224 kg/ha significantly increased marketable head yield compared with 0 and 56 kg/ha.





Figs. 2. & 3. Optimum cabbage head yield estimated using linear-plateau model and quadratic-plateau model was **76** and **124** kg/ha.



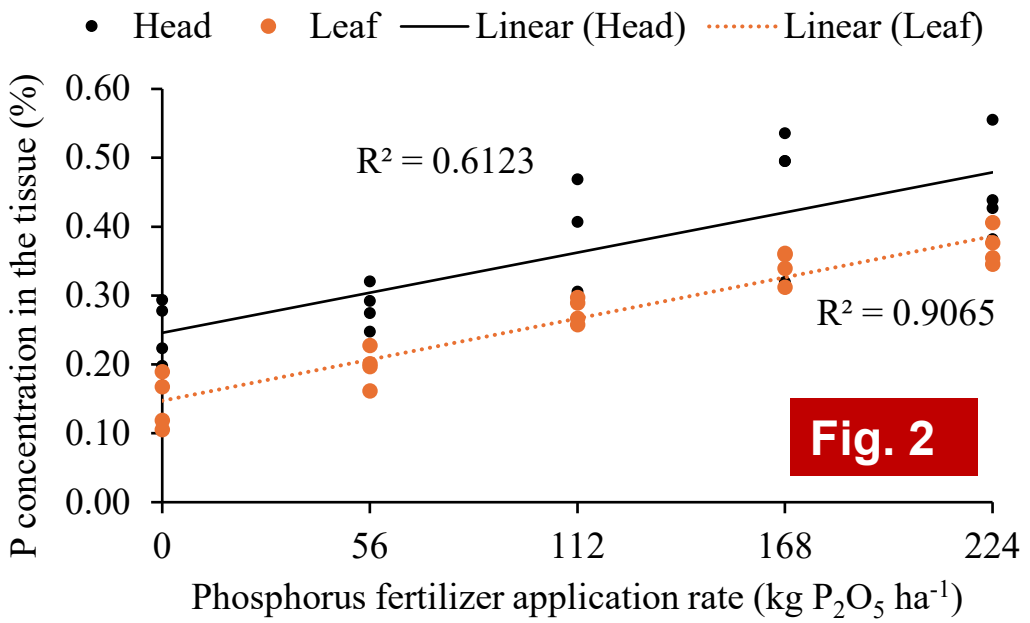
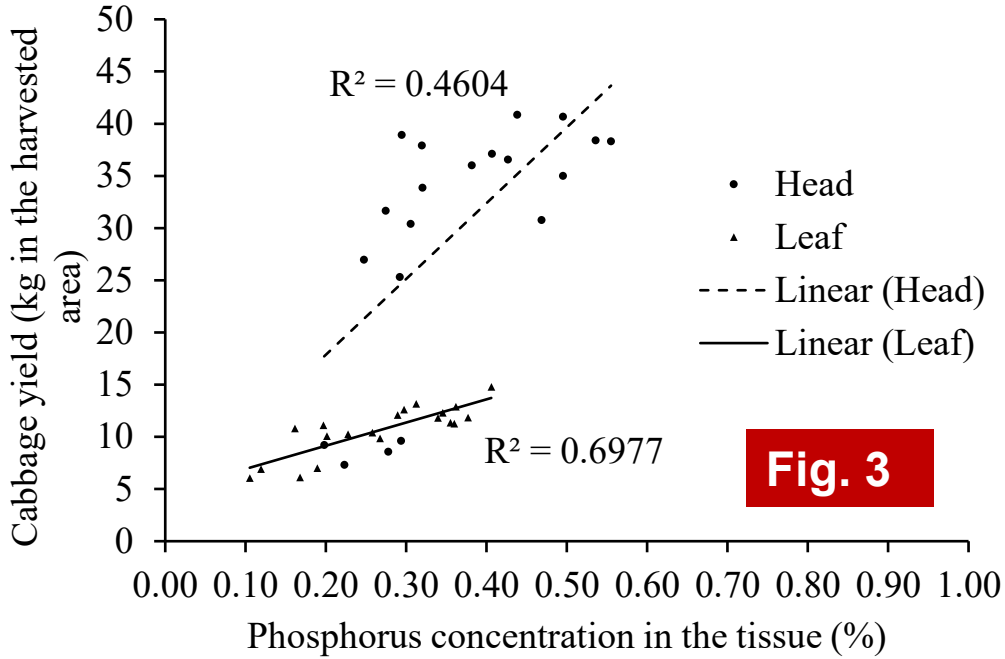


Fig. 1. Marketable head tissue P conc. were significantly higher under 112-224 kg/ha compared with 0 & 56 kg/ha app. rate.

Unmarketable leaf tissue P conc. were highest under 168 & 224 kg/ha, followed by 112 kg/ha, which resulted in significantly higher P conc. compared with 0 & 56 kg/ha app. rates.

Fig. 2. Linear relationship between P app. Rate and tissue P conc. In both marketable head and unmarketable leaf.

Fig. 3. Linear relationship between tissue P conc. Rate and tissue P conc. and marketable head and unmarketable leaf.



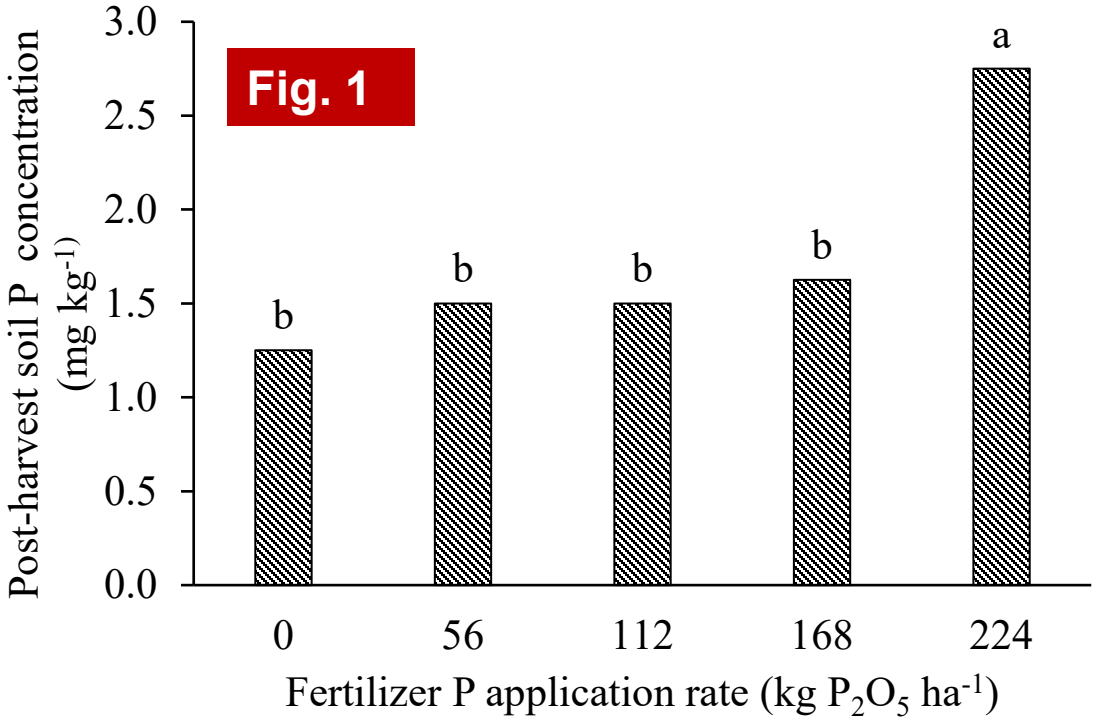


Fig. 1. Only 224 kg/ha app. Rate resulted in significant increase in post-harvest STP.

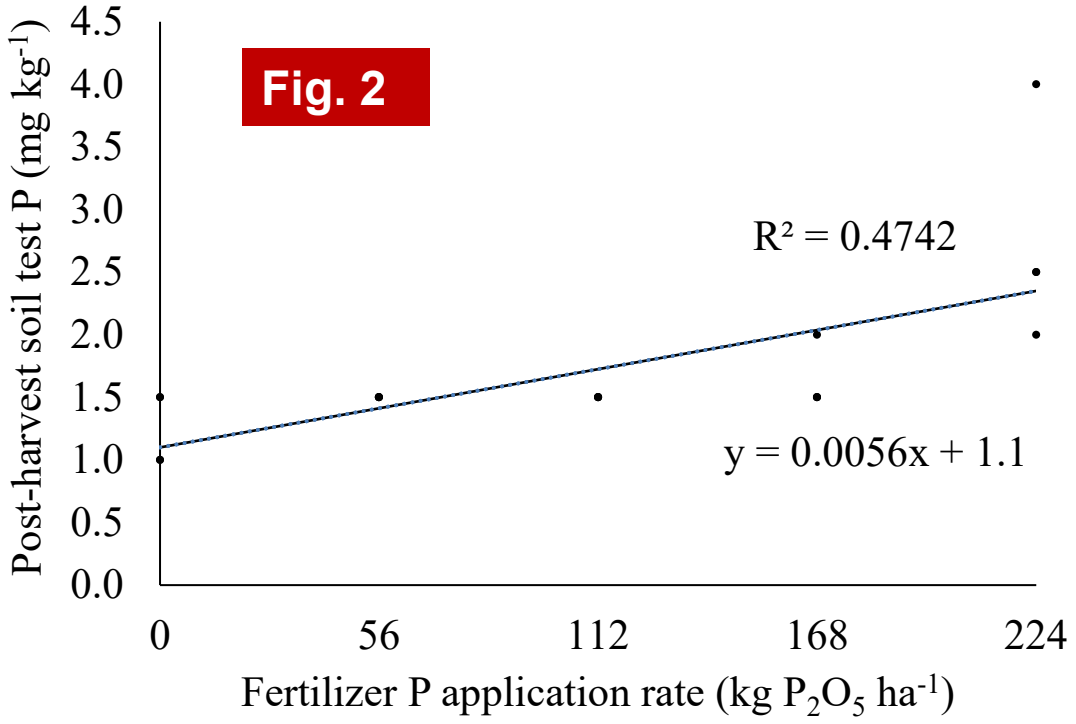


Fig. 2. Linear relationship between P app. rate and post harvest STP.

Silage corn - P

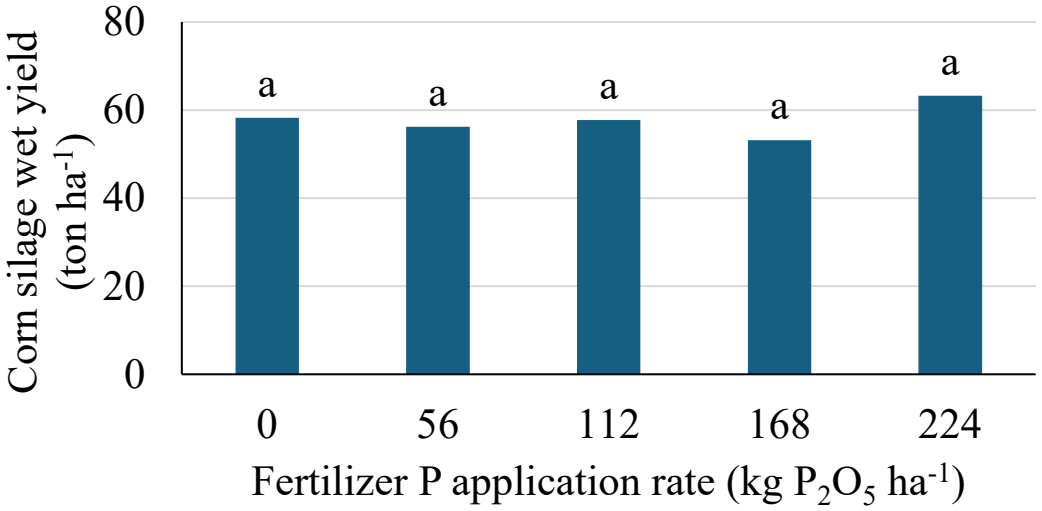


Fig. 1. No sig. treatment effects on the mean yield .

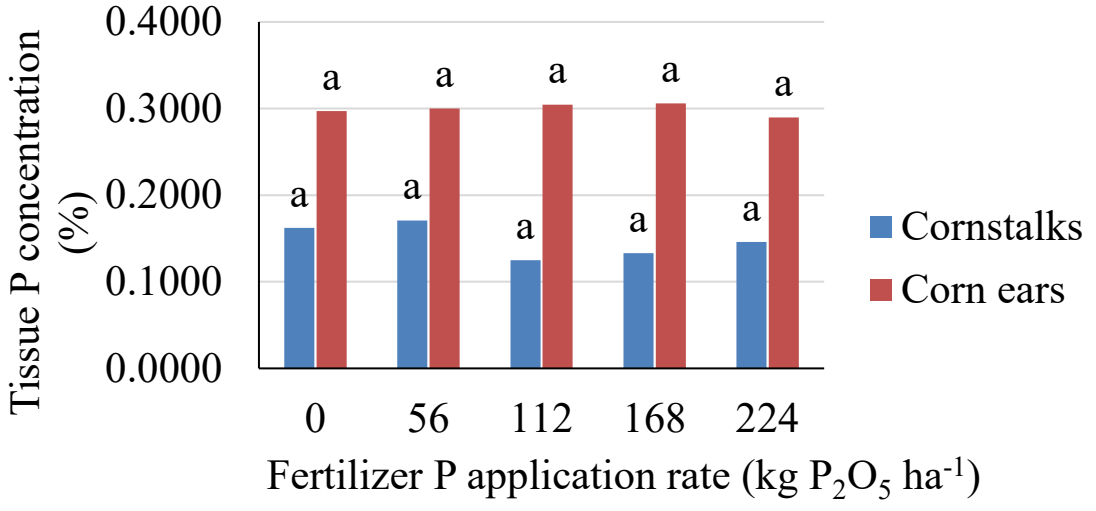


Fig. 2. No sig. treatment effects on the tissue P conc. In cornstalk and corn ears.

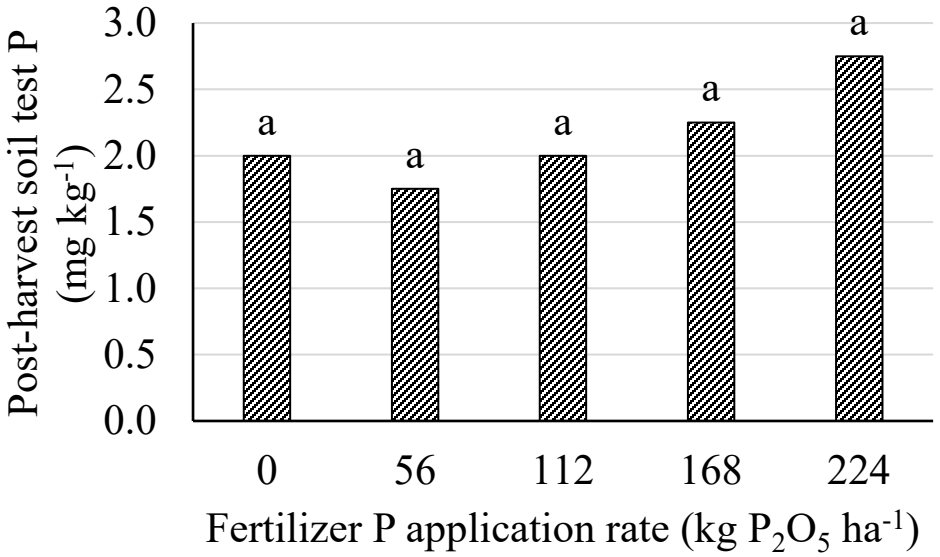


Fig. 3. No sig. treatment effects on the post-harvest STP .

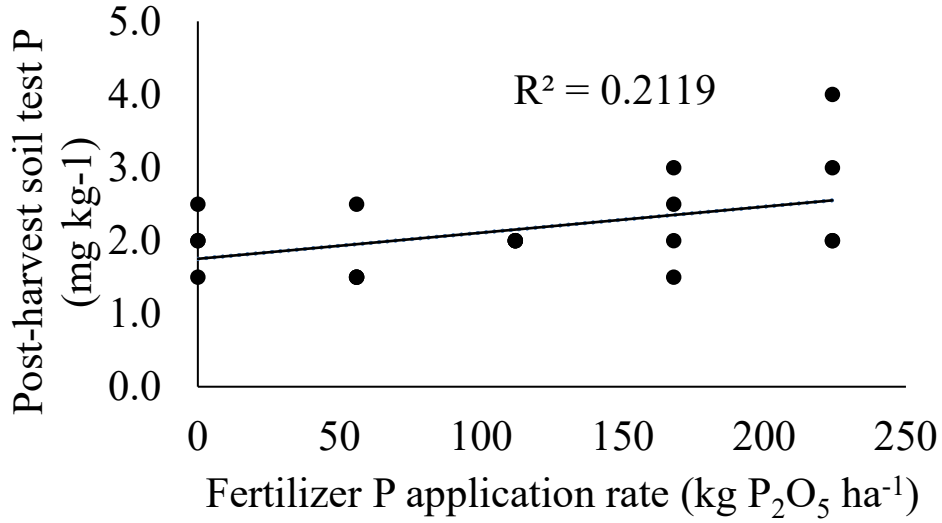


Fig. 4. linear relationship between P app. rate and post-harvest STP .

Fall cabbage - K

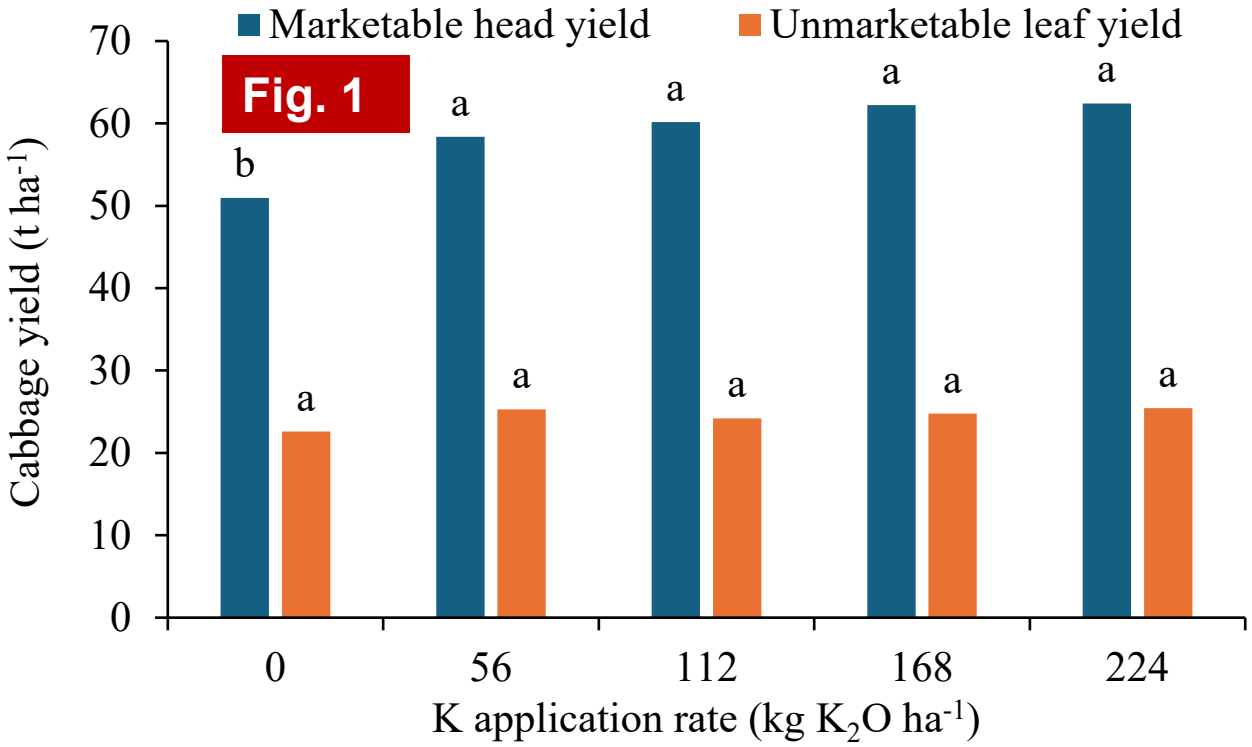
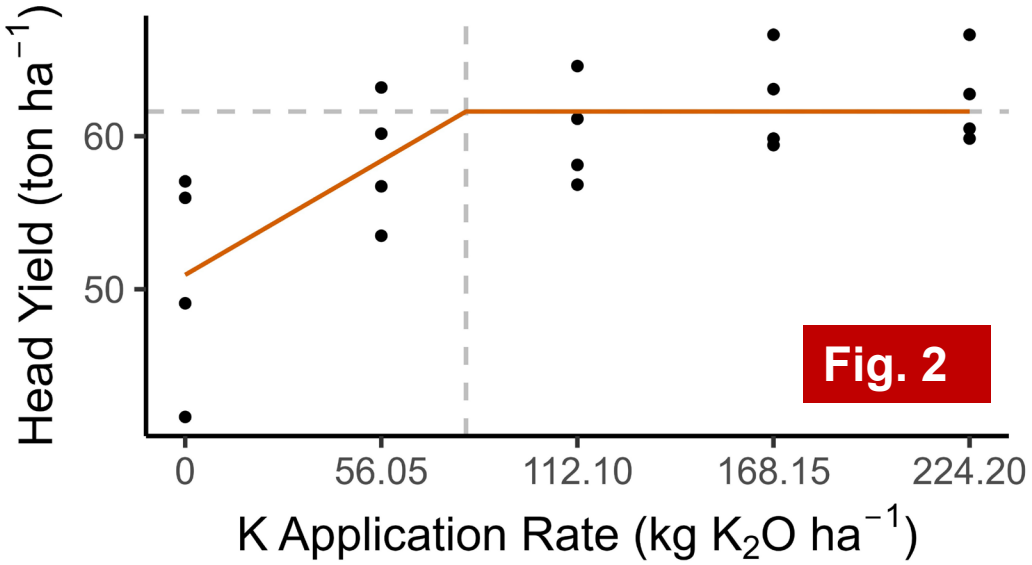
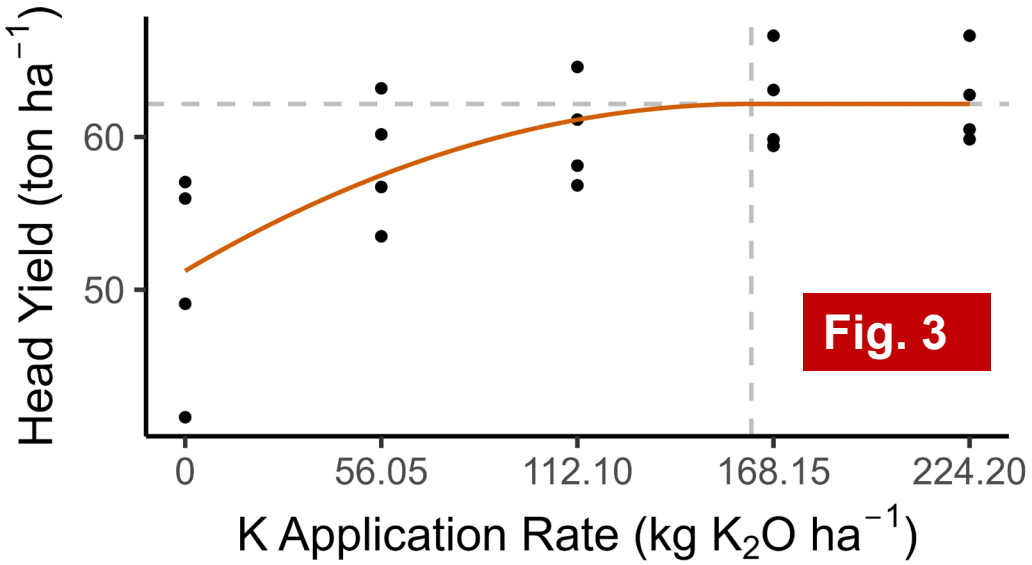


Fig. 1. Application of K resulted in significant higher mean yield of the marketable head, but not unmarketable leaf compared with control.

No significant yield increase at above 56 kg/ha application rate.





Figs. 2. & 3. Optimum cabbage head yield estimated using linear-plateau model and quadratic-plateau model was **80** and **162** kg/ha.

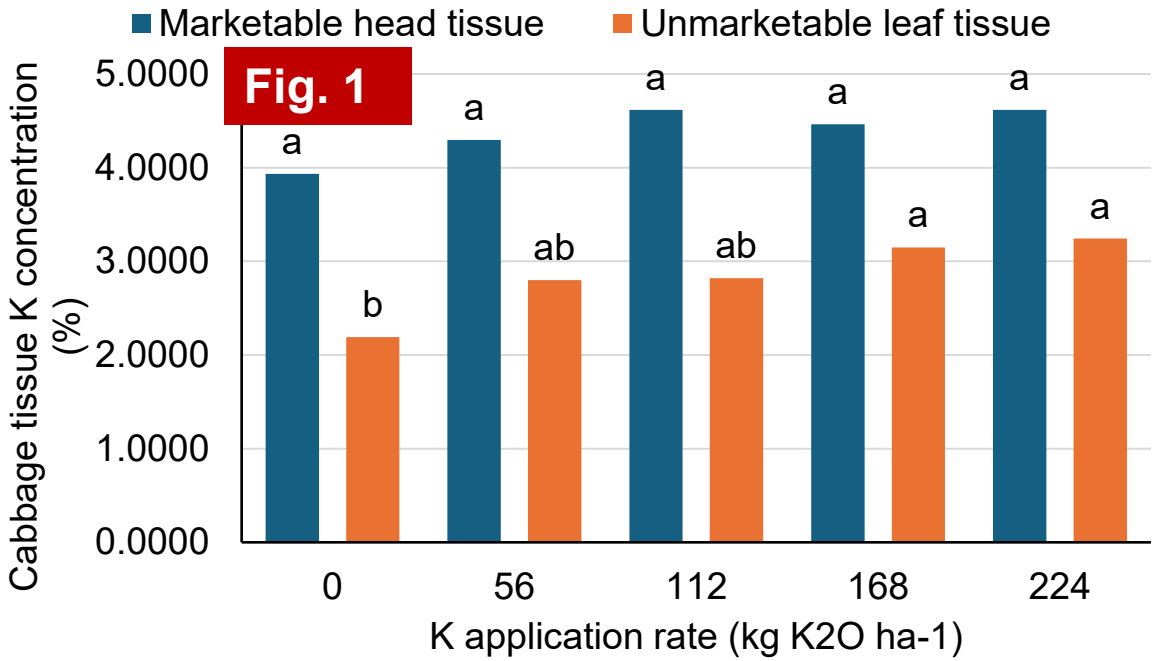


Fig. 1. Marketable head tissue K conc. were not impacted by app. rate (baseline STK=69).

Unmarketable leaf tissue K. were significantly higher in tissue K conc. compared with control.

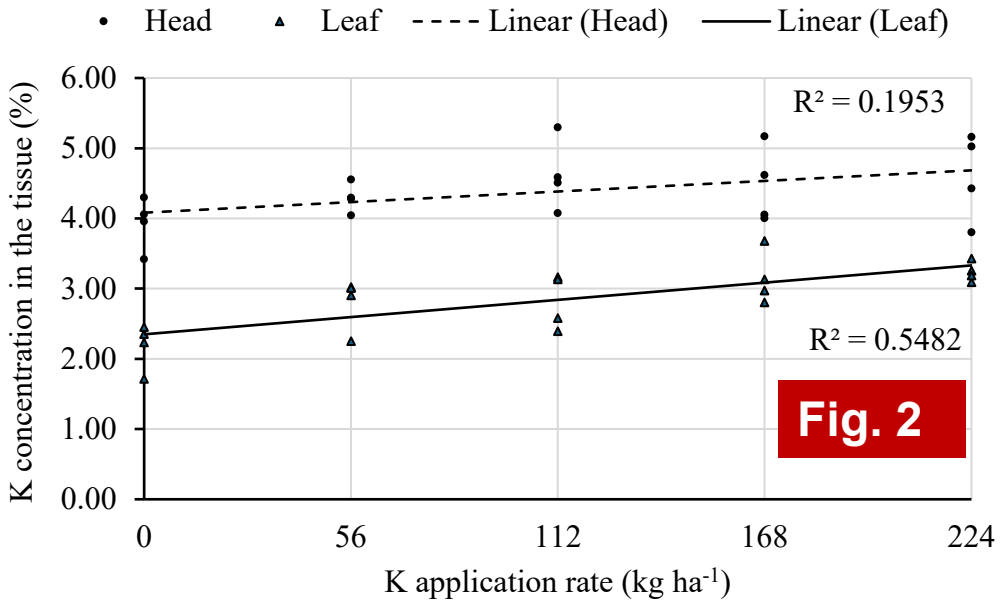


Fig. 2. Linear relationship between K app. rate and tissue K conc. In both marketable head and unmarketable leaf.

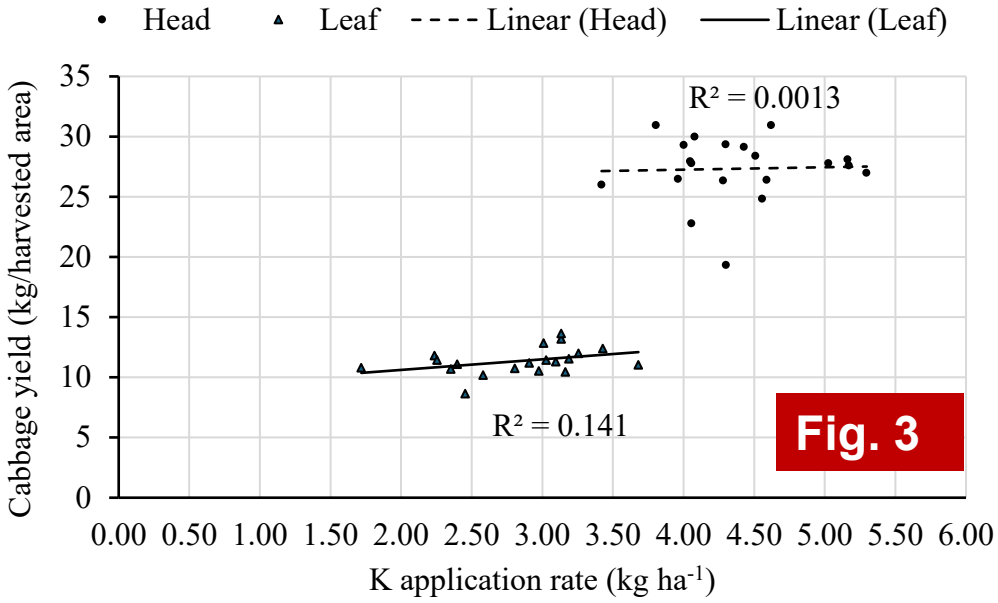


Fig. 3. Linear relationship between tissue K conc. rate and tissue P conc. and marketable head and unmarketable leaf.

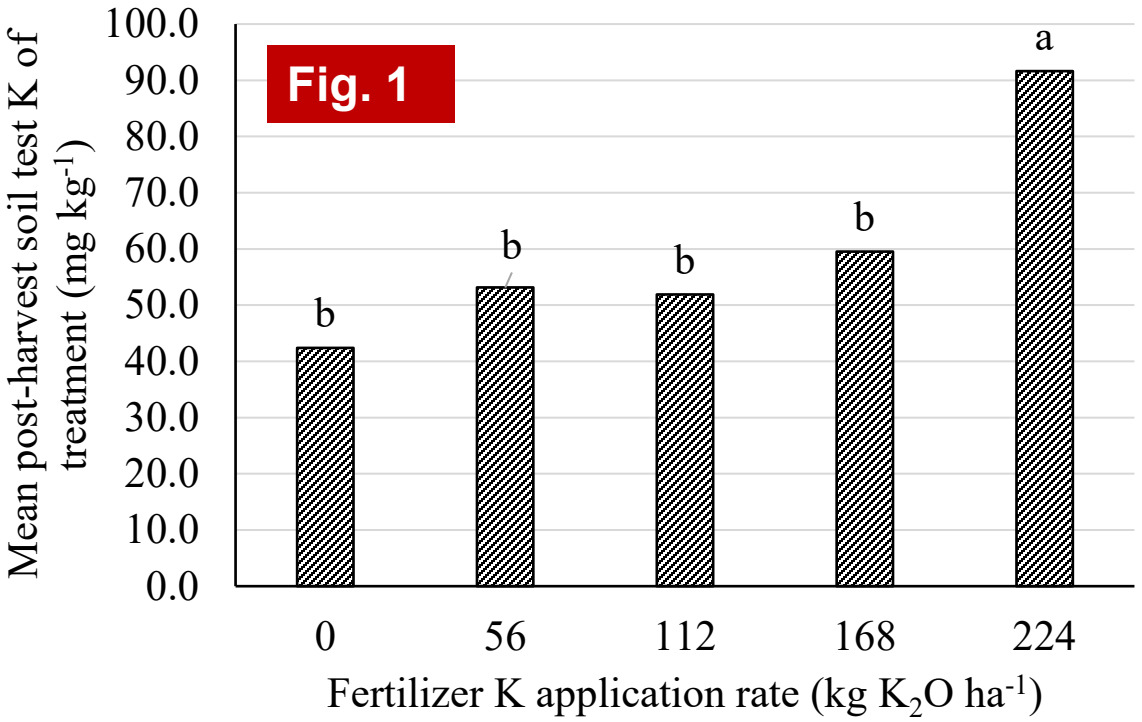


Fig. 1. Only 224 kg/ha app. rate resulted in significant increase in post-harvest STK.

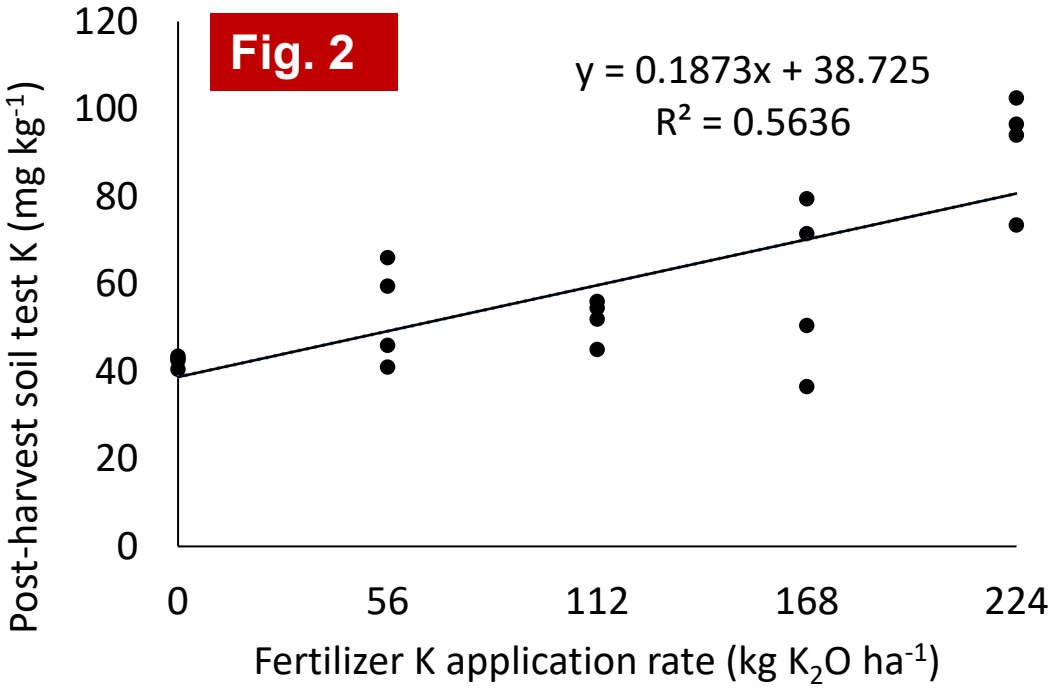


Fig. 2. Linear relationship between K app. rate and post harvest STK.

Silage corn - K

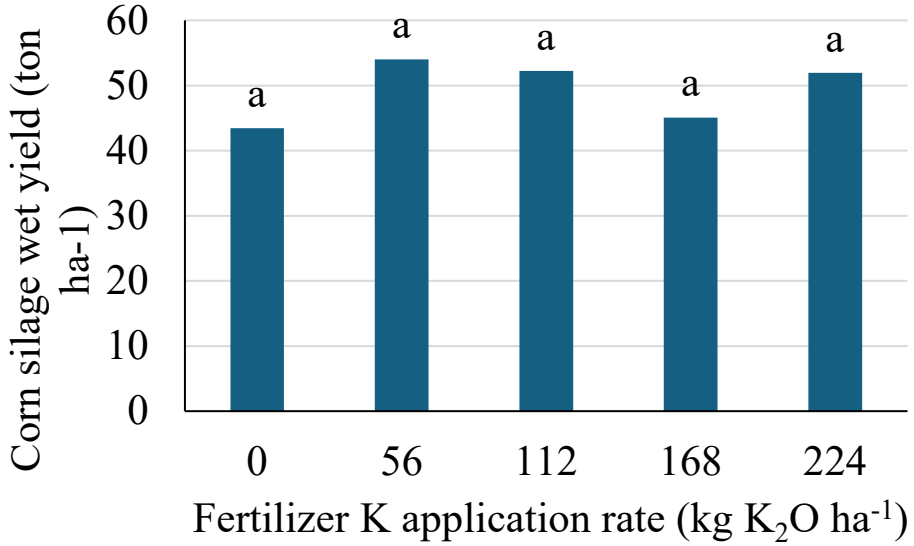


Fig. 1. No sig. treatment effects on the mean yield .

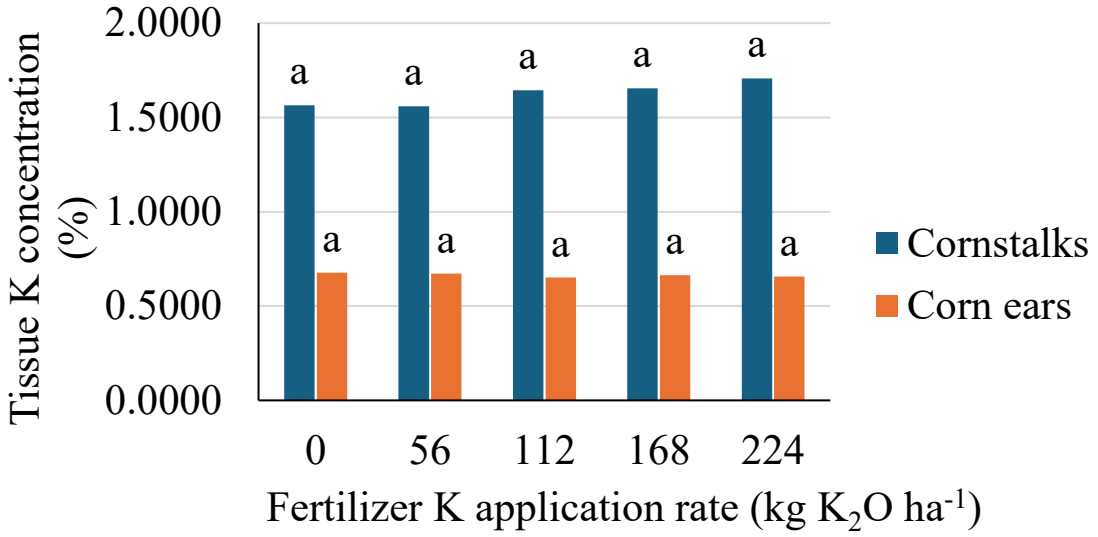


Fig. 2. No sig. treatment effects on the tissue K conc. In cornstalk and corn ears.

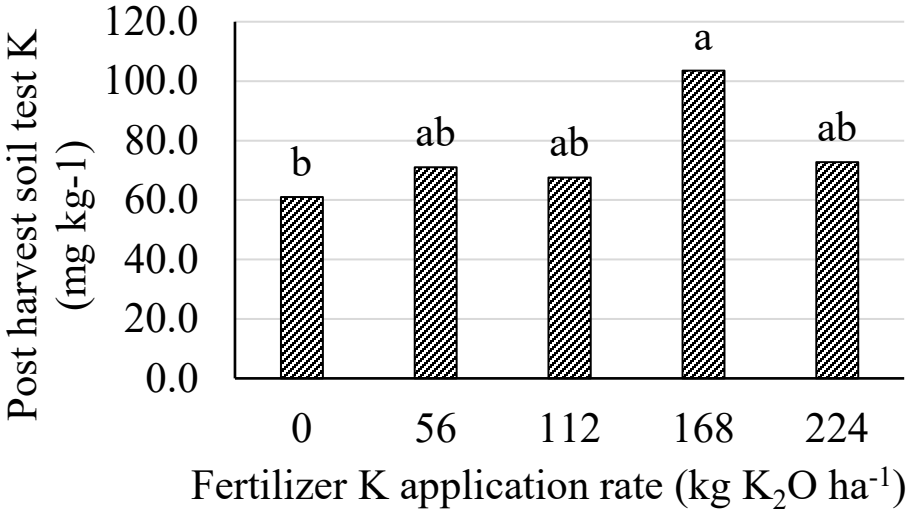


Fig. 3. Only 168kg/ha app. rate resulted in sig. higher post-harvest STK compared with control.

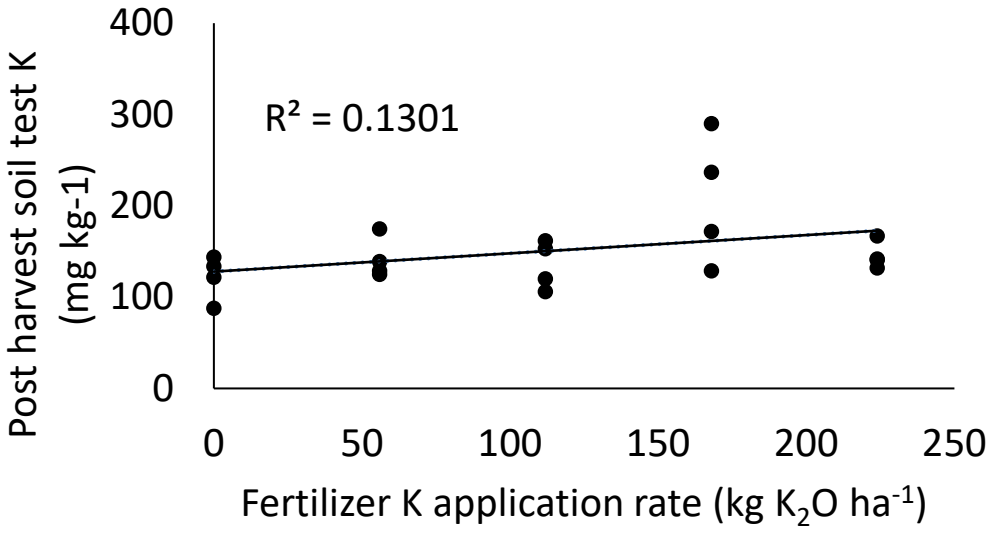


Fig. 4. linear relationship between K app. rate and post-harvest STK .

Conclusion

There were significant responses of cabbage yield, tissue nutrient concentrations to fertilizer P and K application rates when soil test P and K were below the critical soil test values.

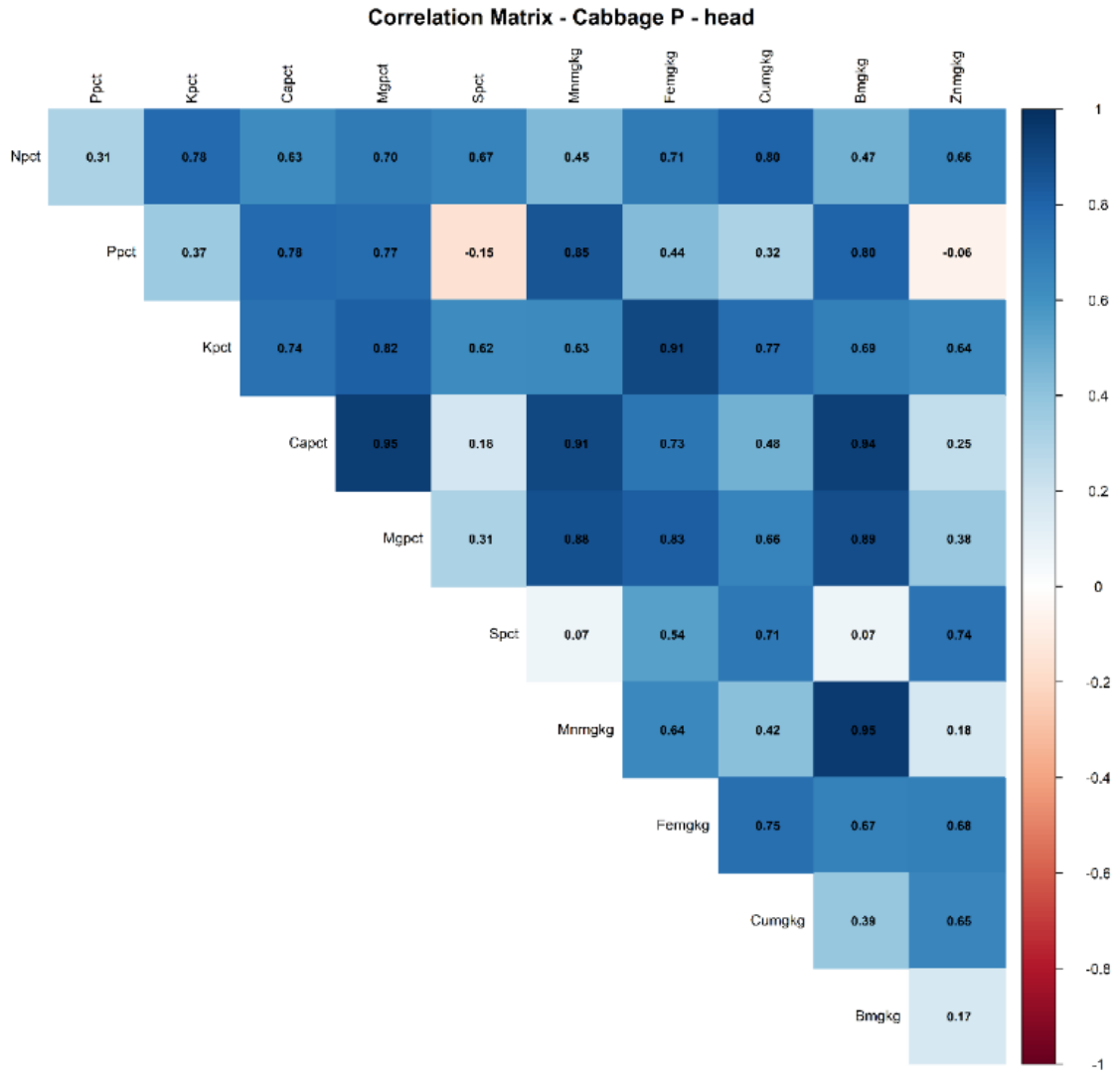
In the cabbage experiments, highest application rates of P and K sig. increased post-harvest soil test values for P and K respectively, and positive linear relationship were shown between post-harvest soil test values and application rates.

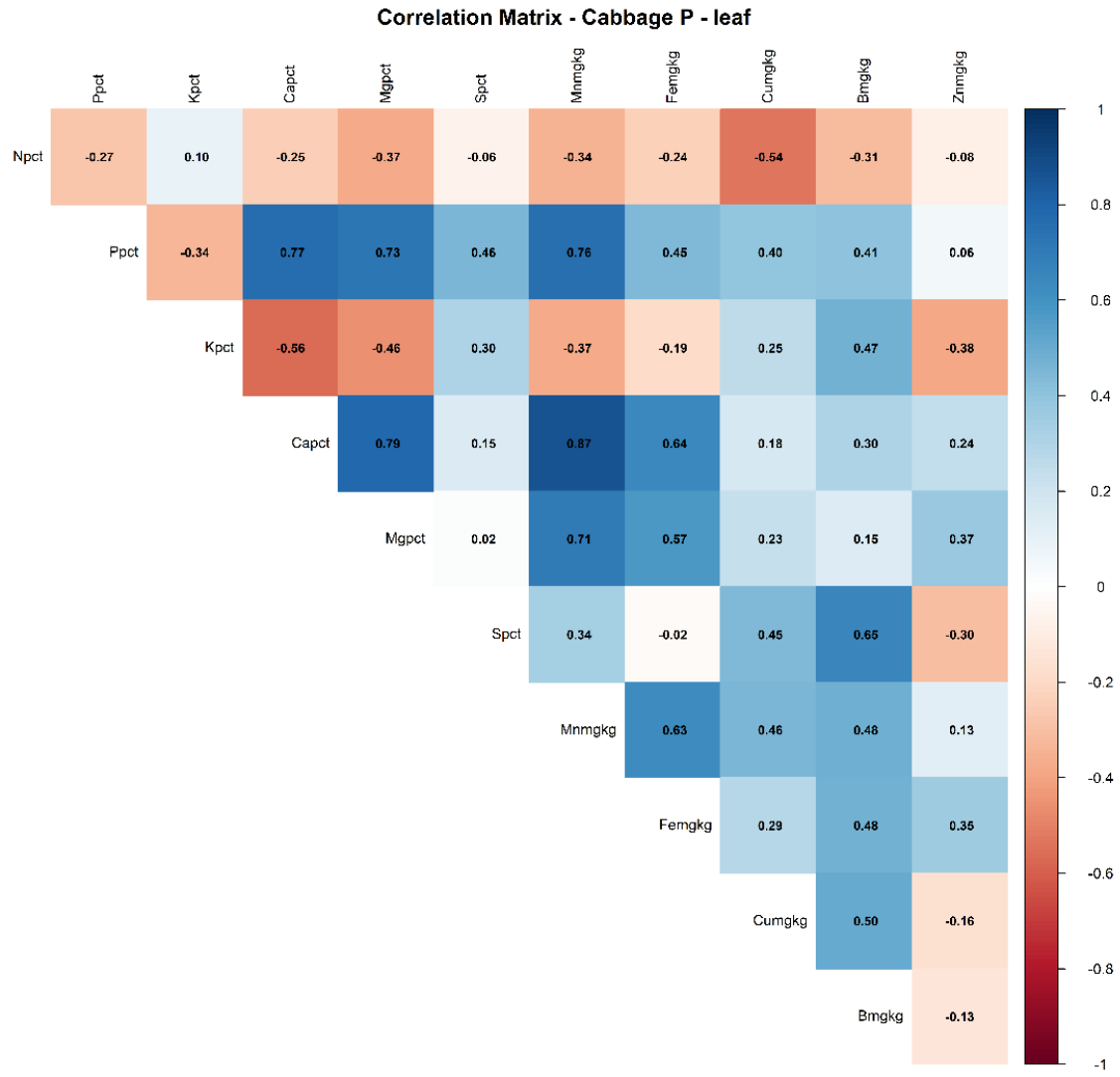
There were no sig. responses of silage corn yield, tissue nutrient concentrations to fertilizer P and K application rates when soil test P and K were below the critical soil test values.

In the silage corn experiments, although a weak positive linear relationship were shown between post-harvest soil test values and application rates, the soil test values were not significantly higher in the fertilized treatments compared with the control.

P and K cycling and crop variety should be studied to interpretate the responsiveness or unresponsiveness.

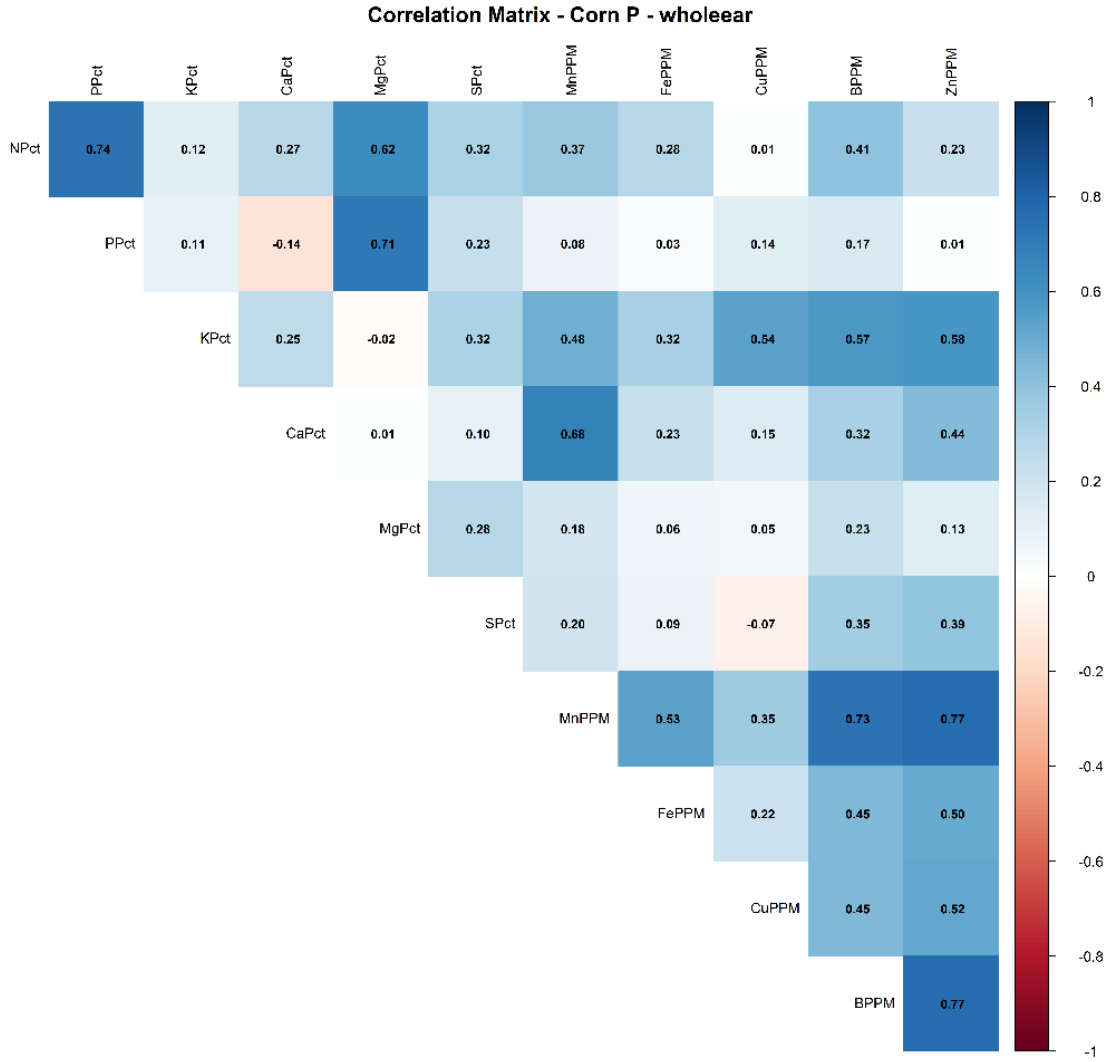
Data presented are all based on the first-year experiment, the second-year experiments will be conducted in 2025.





Positive correlation coefficients between P concentration and other nutrients in the marketable cabbage head:
N (r=0.31), K (r=0.37), Ca (r=0.78), Mg (r=0.77), Mn (r=0.85), Fe (r=0.44), Cu (r=0.32), B (r=0.80)

Positive correlation coefficients between P concentration and other nutrients in the unmarketable cabbage leaf:
Ca (r=0.77), Mg (r=0.73), Mn (r=0.76), Fe (r=0.45), Cu (r=0.40), and B (r=0.41)


Correlation Matrix - Corn P - wholeear
PPct
KPct
CaPct
MgPct
SPct
MnPPM
FePPM
CuPPM
BPPM
ZnPPM
NPct 0.74 0.12 0.27 0.62 0.32 0.37 0.28 0.01 0.41 0.23
PPct 0.11 -0.14 0.71 0.23 0.08 0.03 0.14 0.17 0.01
KPct 0.25 -0.02 0.32 0.48 0.32 0.54 0.57 0.58
CaPct 0.01 0.10 0.68 0.23 0.15 0.32 0.44
MgPct 0.28 0.18 0.06 0.05 0.23 0.13
SPct 0.20 0.09 -0.07 0.35 0.39
MnPPM 0.53 0.35 0.73 0.77
FePPM 0.22 0.45 0.50
CuPPM 0.45 0.52
BPPM 0.77
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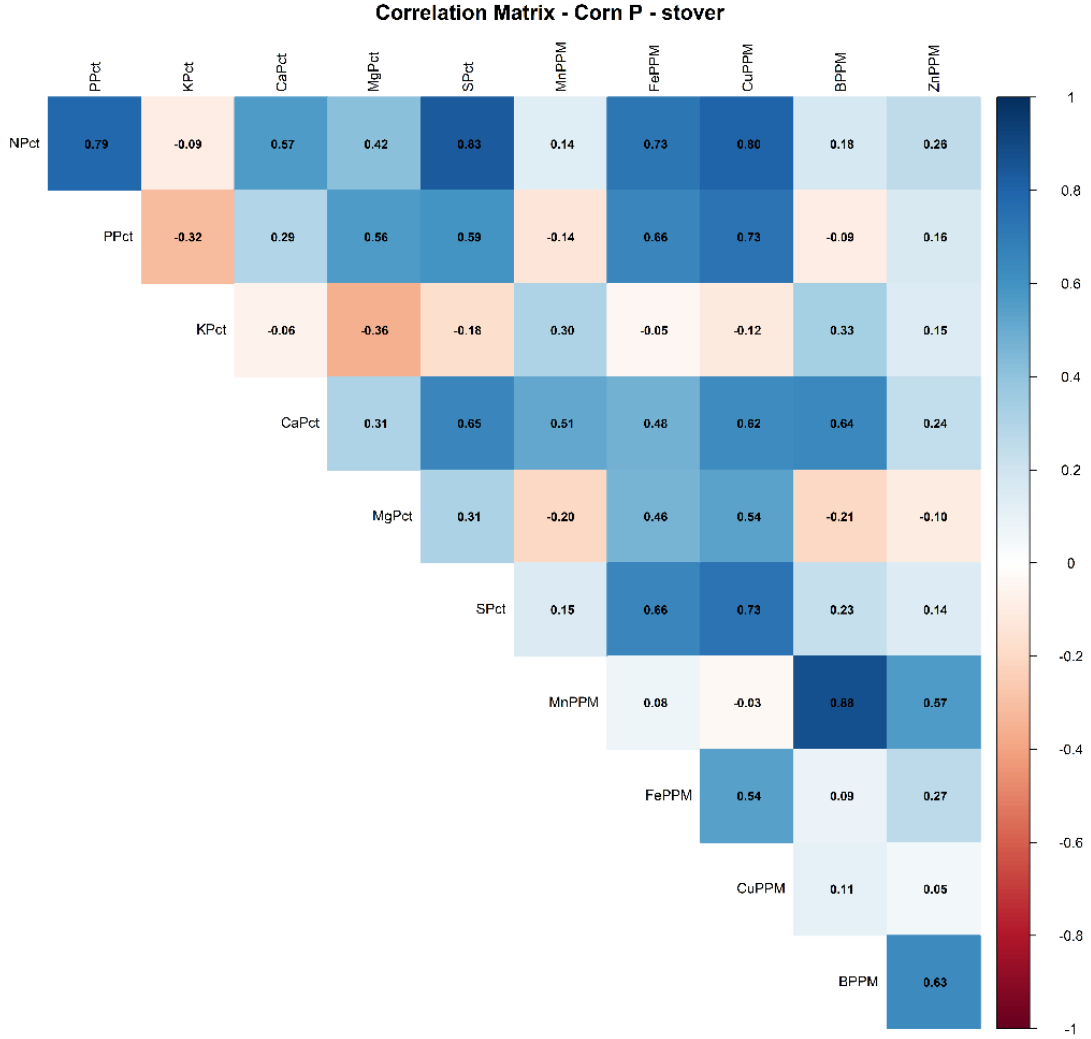
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1


Correlation Matrix - Corn P - stover
PPct
KPct
CaPct
MgPct
SPct
MnPPM
FePPM
CuPPM
BPPM
ZnPPM
NPct 0.79 -0.09 0.57 0.42 0.83 0.14 0.73 0.80 0.18 0.26
PPct -0.32 0.29 0.56 0.59 -0.14 0.66 0.73 -0.09 0.16
KPct -0.06 -0.36 -0.18 0.30 -0.05 -0.12 0.33 0.15
CaPct 0.31 0.65 0.51 0.48 0.62 0.64 0.24
MgPct 0.31 -0.20 0.46 0.54 -0.21 -0.10
SPct 0.15 0.66 0.73 0.23 0.14
MnPPM 0.08 -0.03 0.88 0.57
FePPM 0.54 0.09 0.27
CuPPM 0.11 0.05
BPPM 0.63
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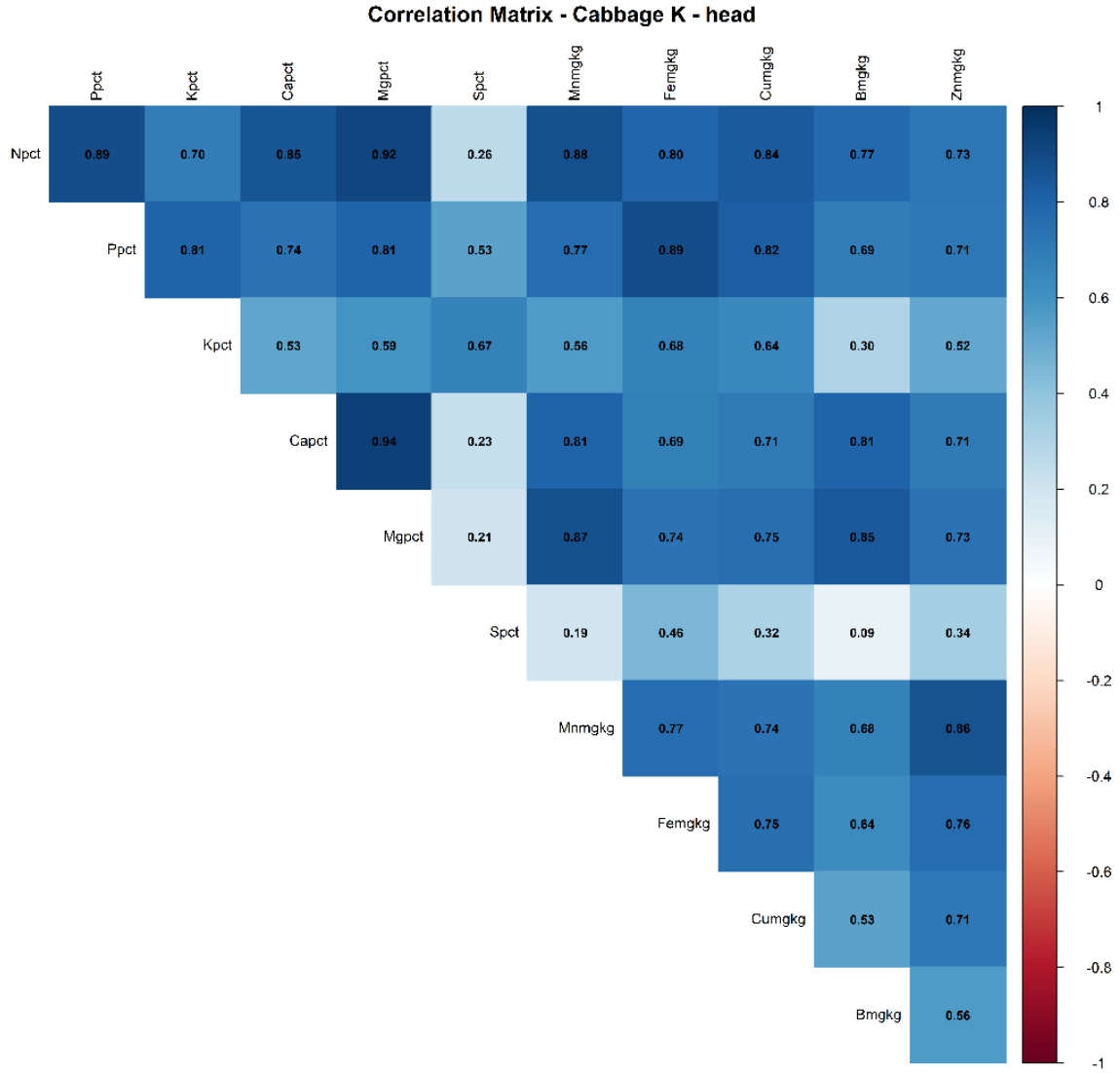
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1


Correlation Matrix - Cabbage K - head
Ppct
Kpct
Capct
Mgpct
Spct
Mnmgkg
Femgkg
Cumgkg
Bmgkg
Znmgkg
Npct 0.89 0.70 0.85 0.92 0.26 0.88 0.80 0.84 0.77 0.73
Ppct 0.81 0.74 0.81 0.53 0.77 0.89 0.82 0.69 0.71
Kpct 0.53 0.59 0.67 0.56 0.68 0.64 0.30 0.52
Capct 0.94 0.23 0.81 0.69 0.71 0.81 0.71
Mgpct 0.21 0.87 0.74 0.75 0.85 0.73
Spct 0.19 0.46 0.32 0.09 0.34
Mnmgkg 0.77 0.74 0.68 0.86
Femgkg 0.75 0.64 0.76
Cumgkg 0.53 0.71
Bmgkg 0.56
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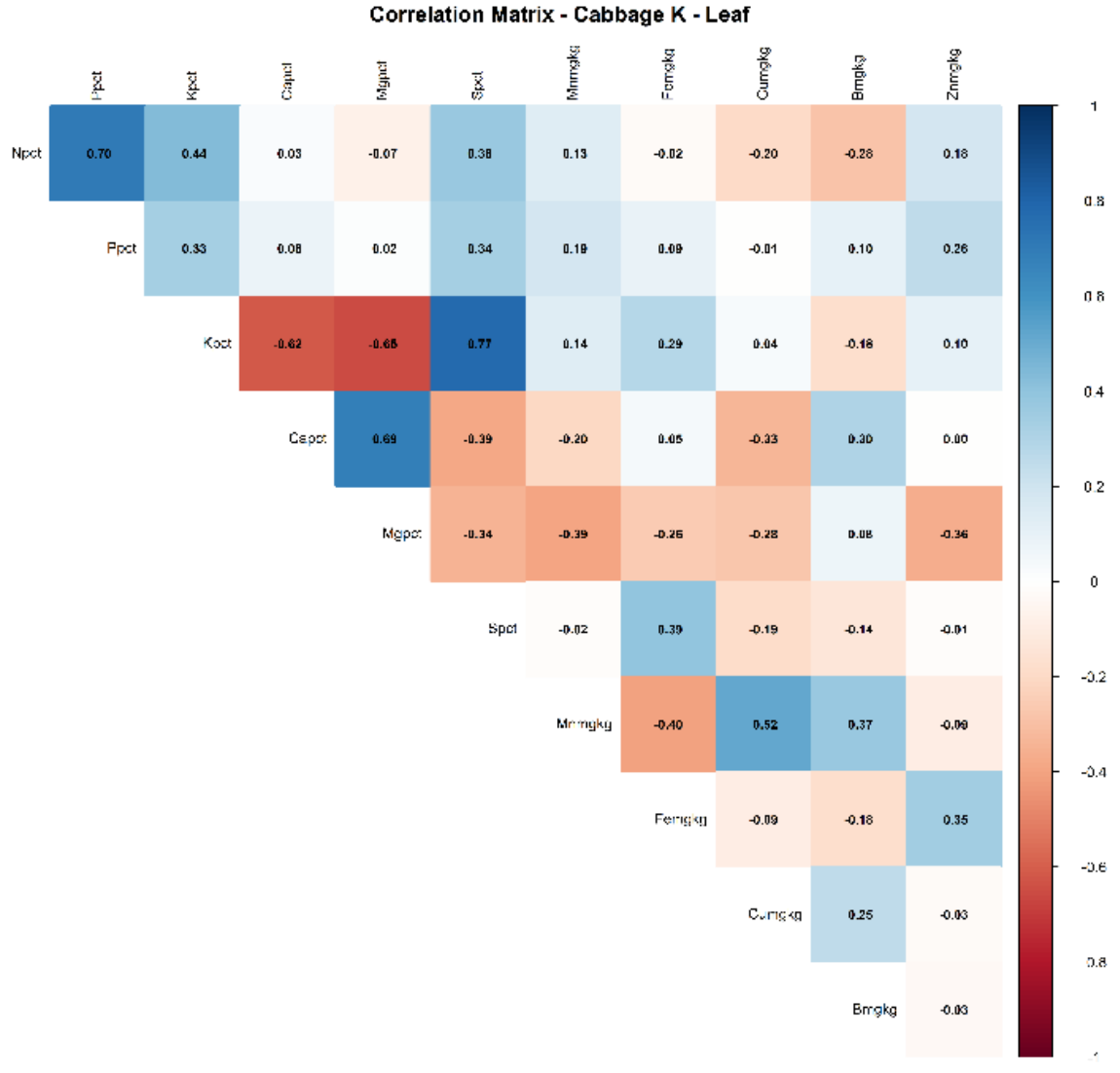
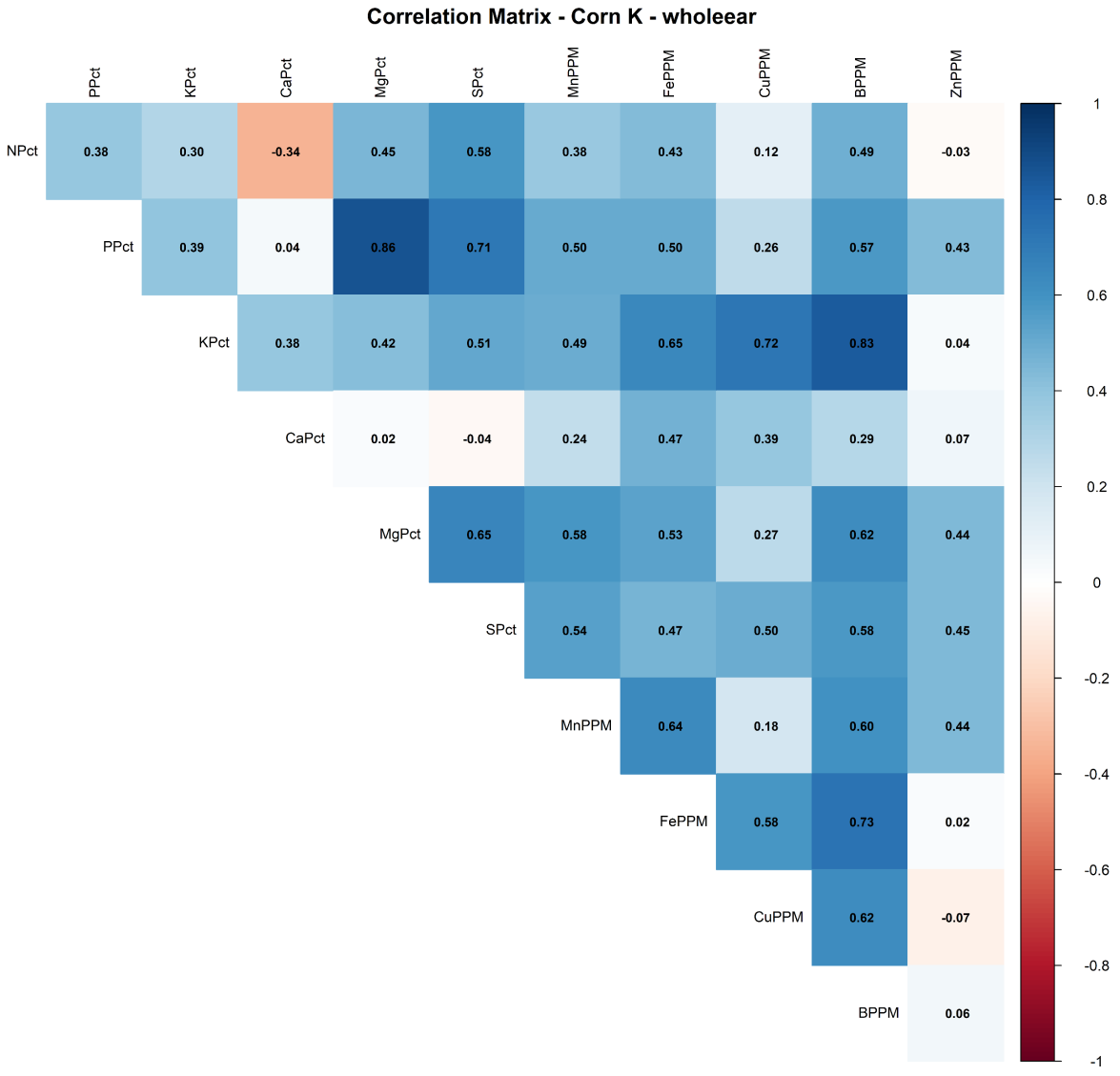
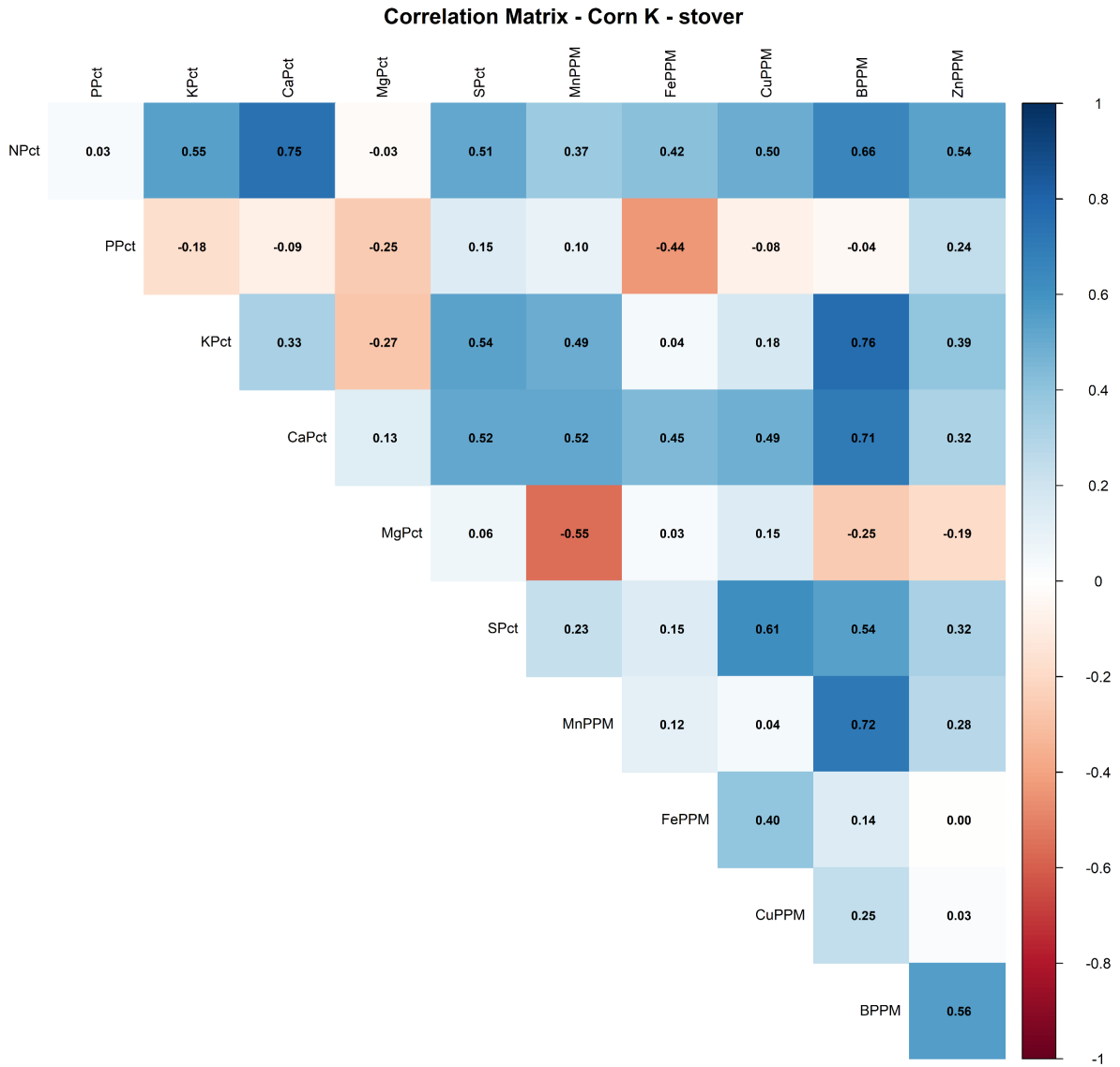
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1


Correlation Matrix - Cabbage K - Leaf
Npct 0.70 0.44 0.03 -0.07 0.38 0.13 -0.02 -0.20 -0.28 0.18
Ppct 0.33 0.08 0.02 0.34 0.19 0.09 -0.01 0.10 0.26
Kpct -0.62 -0.65 0.77 0.14 0.29 0.04 -0.18 0.10
Capct 0.69 -0.39 -0.20 0.05 -0.33 0.30 0.00
Mgpct -0.34 -0.39 -0.25 -0.28 0.08 -0.36
Spct -0.02 0.39 -0.19 -0.14 -0.01
Mnmgkg -0.40 0.52 0.37 -0.09
Femgkg -0.09 -0.18 0.35
Cumgkg 0.25 -0.03
Bmgkg -0.03
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8


Correlation Matrix - Corn K - wholeear
PPct KPct CaPct MgPct SPct MnPPM FePPM CuPPM BPPM ZnPPM
NPct 0.38 0.30 -0.34 0.45 0.58 0.38 0.43 0.12 0.49 -0.03
PPct 0.39 0.04 0.86 0.71 0.50 0.50 0.26 0.57 0.43
KPct 0.38 0.42 0.51 0.49 0.65 0.72 0.83 0.04
CaPct 0.02 -0.04 0.24 0.47 0.39 0.29 0.07
MgPct 0.65 0.58 0.53 0.27 0.62 0.44
SPct 0.54 0.47 0.50 0.58 0.45
MnPPM 0.64 0.18 0.60 0.44
FePPM 0.58 0.73 0.02
CuPPM 0.62 -0.07
BPPM 0.06
1 0.8 0.6 0.4 0.2 0 -0.2 -0.4 -0.6 -0.8 -1


Correlation Matrix - Corn K - stover
PPct KPct CaPct MgPct SPct MnPPM FePPM CuPPM BPPM ZnPPM
NPct 0.03 0.55 0.75 -0.03 0.51 0.37 0.42 0.50 0.66 0.54
PPct -0.18 -0.09 -0.25 0.15 0.10 -0.44 -0.08 -0.04 0.24
KPct 0.33 -0.27 0.54 0.49 0.04 0.18 0.76 0.39
CaPct 0.13 0.52 0.52 0.45 0.49 0.71 0.32
MgPct 0.06 -0.55 0.03 0.15 -0.25 -0.19
SPct 0.23 0.15 0.61 0.54 0.32
MnPPM 0.12 0.04 0.72 0.28
FePPM 0.40 0.14 0.00
CuPPM 0.25 0.03
BPPM 0.56
1 0.8 0.6 0.4 0.2 0 -0.2 -0.4 -0.6 -0.8 -1

Acknowledgement