Supplementary Table S1. Soil analysis characteristics used in pot

Soil Characteristics	Before Sowing
pH	8.11
EC_e ($\mu S\ cm^{-1}$)	300
Organic matter (%)	0.75
Total-N (%)	0.010
NO3-N ($mg\ kg^{-1}$)	5.26
$NaHCO_3$-P ($mg\ kg^{-1}$)	11.5
NH_4OAC-K ($mg\ kg^{-1}$)	100
Textural Class	Silt loam

Supplementary Table S2. Pearson's correlation matrix for nutrient use efficiency indices determining nutrient efficiency of cultivars under AWC-100%

Parameters	SCY	NAE	KAE	NPE	KPE	NARE	KARE	NEU	KEU	NIE	KIE	NER	KER	LN	LK	NU
NAE	0.855**	1														
KAE	0.887**	0.781**	1													
NPE	-0.007 NS	-0.173 NS	0.015 NS	1												
KPE	0.089 NS	0.112 NS	-0.253 NS	0.262 NS	1											
NARE	0.851**	0.992**	0.733**	-0.181 NS	0.18 NS	1										
KARE	0.864**	0.754**	0.991**	0.071 NS	-0.278 NS	0.708*	1									
NEU	0.820**	0.984**	0.681*	-0.179 NS	0.244 NS	0.996**	0.655*	1								
KEU	0.873**	0.780**	0.997**	0.039 NS	-0.262 NS	0.735**	0.995**	0.683*	1							
NIE	-0.038 NS	-0.119 NS	-0.014 NS	0.918**	0.401 NS	-0.143 NS	0.028 NS	-0.121 NS	0.003 NS	1						
KIE	0.251 NS	0.259 NS	-0.04 NS	0.334 NS	0.967**	0.306 NS	-0.068 NS	0.361 NS	-0.049 NS	0.501 NS	1					
NER	-0.158 NS	-0.271 NS	0.131 NS	0.751**	-0.347 NS	-0.349 NS	0.186 NS	-0.379 NS	0.15 NS	0.697*	-0.231 NS	1				
KER	0.295 NS	0.317 NS	-0.036 NS	-0.038 NS	.888**	0.379 NS	-0.109 NS	0.424 NS	-0.062 NS	0.087 NS	0.883**	-0.568 NS	1			
LN	0.918**	0.827**	0.698*	-0.21 NS	0.287 NS	0.862**	0.665*	0.851**	0.686*	-0.222 NS	0.382 NS	-0.507 NS	0.517 NS	1		
LK	0.786**	0.625*	0.895**	0.217 NS	-0.34 NS	0.581*	0.937**	0.53	0.906**	0.137 NS	-0.155 NS	0.329 NS	-0.297 NS	0.551 NS	1	
NU	0.966**	0.839**	0.768**	-0.138 NS	0.203 NS	0.863**	0.736**	0.842**	0.753**	-0.18 NS	0.317 NS	-0.388 NS	0.436 NS	0.983**	0.639*	1
KU	0.970**	0.817**	0.933**	0.06 NS	-0.084 NS	0.800**	0.935**	0.759**	0.929**	0.001 NS	0.09 NS	0.005 NS	0.072 NS	0.828**	0.910**	0.895**

SCY : Seed cotton yield
NAE :Nitrogen agronomic efficiency:
KAE : Potassium agronomic efficiency:
NPE : Nitrogen physiological efficiency
KPE : Potassium physiological efficiency
NARE :Nitrogen apparent recovery efficiency
KARE : Potassium apparent recovery efficiency
NEU : Nitrogen utilization efficiency
KEU : Potassium utilization efficiency
NIE : Nitrogen internal utilization efficiency
KIE : Potassium internal utilization efficiency
NER : Nitrogen efficiency ratio
KER : Potassium efficiency ratio
LN : Leaf nitrogen concentration
LK : Leaf Potassium concentration
NU : Total nitrogen uptake
KU : Total potassium uptake
*= Highly significant at $p \leqslant 0.01$; * = Significant at $p \leqslant 0.05$; NS = Non-significant*

Supplementary Table S3. Effect of applied N: K levels on nutrient utilization and agronomy efficiency in cotton cultivars under varied irrigation levels.

N: K levels (mg pot^{-1})	N utilization efficiency (mg mg^{-1})					K utilization efficiency (mg mg^{-1})				
	[x]100% AWC		[y]50% AWC		Mean	100% AWC		50% AWC		Mean
	HKE	LKE	HKE	LKE		HKE	LKE	HKE	LKE	
0-0	-	-	-	-	-	-	-	-	-	-
375-0	11.4	9.2	5.3	4.0	**7.5 c**	-	-	-	-	-
750-0	11.8	9.5	6.3	4.3	**8.0 b**	-	-	-	-	-
0-208	0.0	0.0	0.0	0.0	**-**	16.1	12.1	8.2	4.3	**10.2 c**
375-208	17.1	14.7	17.1	15.7	**16.2 a**	30.9	26.5	30.9	28.3	**29.2 a**
750-208	9.4	8.4	9.4	10.5	**9.4 ab**	11.0	10.5	19.0	21.8	**15.6 b**
Cv x MR	**8.3 a**	**7.0 b**	**6.4bc**	**5.8c**		**9.7 a**	**8.2b**	**9.7 a**	**9.1 ab**	
Mean MR	**7.65 a**		**6.10 b**			**8.75 b**		**9.40 a**		
Mean Cv	**HKE = 7.35a, LKE = 6.40b**					**HKE = 9.7a, LKE= 8.7a**				
	N agronomic use efficiency (mg SCY /mg N)					**K agronomic use efficiency (mg SCY /mg N)**				
0-0	-	-	-	-		-	-	-	-	-
375-0	26.9	21.6	9.1	13.6	**17.8 c**	-	-	-	-	-
750-0	24.5	19.3	12.4	11.9	**17.0 c**	-	-	-	-	-
0-208	-	-	-	-		44.2	34.1	12.5	20.2	**27.8 c**
375-208	66.9	48.5	63.7	49.1	**57.1 a**	116.3	82.7	111.1	84.1	**98.6 a**
750-208	37.1	28.5	35.5	27.5	**32.2 b**	89.4	67.3	95.7	76.4	**82.2 b**
Cv x MR	**25.9a**	**19.7b**	**20.1b**	**17.0c**		**41.7 a**	**30.7c**	**36.5 b**	**30.1c**	
Mean MR	**22.8a**		**18.6b**			**36.2a**		**33.3b**		
Mean Cv	**HKE = 36.0 a, LKE = 28.2 b**					**HKE = 39.1a, LKE = 30.4b**				

Means not sharing the same letter within a column differ significantly at $P<0.05$ by LSD test. [x] Full available moisture contents (100% irrigation), [y]50% reduced available moisture content

Supplementary Table S4. Effect of applied N: K levels on physiological and internal utilization efficiency in cotton cultivars under varied irrigation levels.

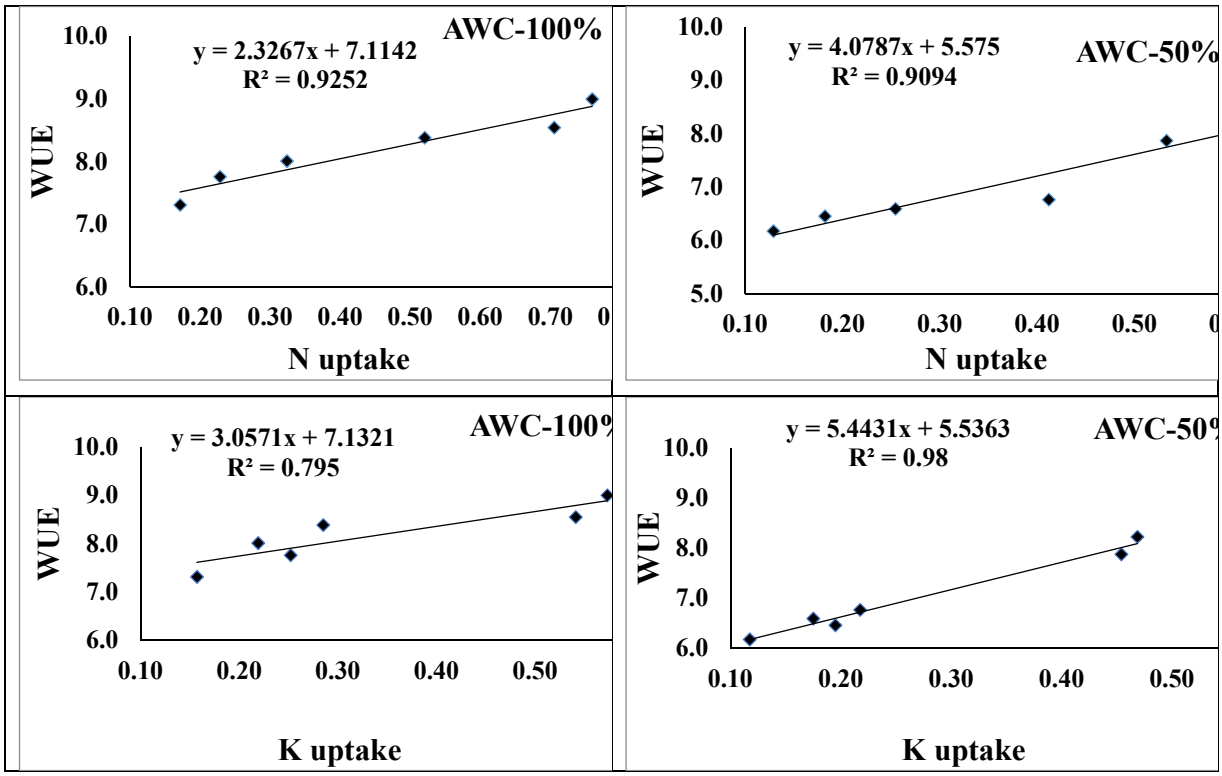
N: K levels (mg pot^{-1})	N physiological use efficiency (mg mg^{-1})				Mean	K physiological use efficiency (mg mg^{-1})				Mean
	[x]100% AWC		[y]50% AWC			100% AWC		50% AWC		
	HKE	LKE	HKE	LKE		HKE	LKE	HKE	LKE	
0-0	-	-	-	-		-	-	-	-	-
375-0	19.2	19.5	17.6	16.5	**18.2 a**	-	-	-	-	-
750-0	16.9	18.1	17.8	18.9	**17.9 a**	-	-	-	-	-
0-208	-	-	-	-		14.1	19.2	20.1	14.9	**17.1 a**
375-208	14.9	15.2	16.8	19.9	**16.7 a**	13.9	13.0	16.2	18.3	**15.4 ab**
750-208	12.3	10.5	14.8	18.3	**14.0 ab**	8.8	5.6	11.4	13.8	**9.9 b**
Cv x MR	**10.6c**	**10.6c**	**11.2b**	**12.3a**		**6.1c**	**6.3c**	**7.9 a**	**7.8 b**	
Mean MR	**10.60b**		**11.75a**			**6.20 b**		**7.85 a**		
Mean Cv	**HKE = 10.9a, LKE = 11.45b**					**HKE = 7.0a, LKE= 7.1a**				
	N internal use efficiency (mg mg^{-1})					K internal use efficiency (mg mg^{-1})				
0-0	-	-	-	-		-	-	-	-	-
375-0	14.7	16.0	8.7	21.3	**15.2 a**	-	-	-	-	-
750-0	13.2	12.5	11.6	15.2	**13.1 b**	-	-	-	-	-
0-208	-	-	-	-		11.4	16.8	6.1	14.4	**12.2 c**
375-208	13.7	13.0	17.8	16.1	**15.2 a**	17.1	15.0	20.6	17.4	**17.5 a**
750-208	8.8	8.9	13.2	12.5	**10.9 c**	13.8	12.9	17.5	15.5	**14.9 b**
Cv x MR	**8.4 b**	**8.4 b**	**8. 6 b**	**10.9 a**		**7.06b**	**7.47 ab**	**7.37 ab**	**7.89 a**	
Mean MR	**4.4b**		**10.9a**			**7.27a**		**7.63a**		
Mean Cv	**HKE = 8.5 b, LKE = 9.7 a**					**HKE = 7.22a, LKE = 7.68a**				

Means not sharing the same letter within a column differ significantly at $P<0.05$ by LSD test. [x] Full available moisture contents, [y]50% reduced available moisture content

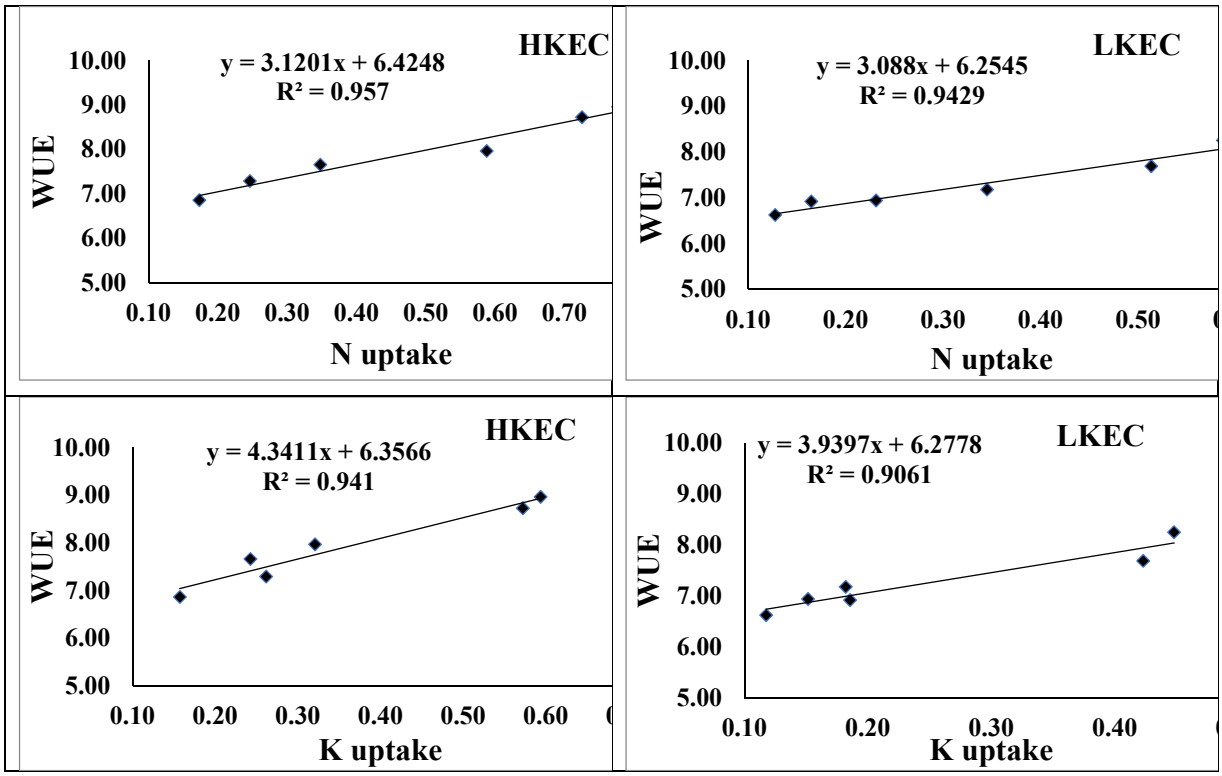
Supplementary Table S5. Pearson's correlation matrix for nutrient use efficiency indices determining nutrient efficiency of cultivars under AWC-50%

Parameters	SCY	NAE	KAE	NPE	KPE	NARE	KARE	NEU	KEU	NIE	KIE	NER	KER	LN	LK	NU
SCY	1															
NAE	0.882**	1														
KAE	0.947**	0.867**	1													
NPE	-0.069NS	-0.147 NS	-0.025 NS	1												
KPE	-0.006 NS	0.014 NS	-0.234 NS	0.072 NS	1											
NARE	0.882**	0.994**	0.838**	-0.16 NS	0.085 NS	1										
KARE	0.946**	0.860**	0.995**	0.014 NS	-0.246 NS	0.830**	1									
NEU	0.866**	0.992**	0.826**	-0.154 NS	0.074 NS	0.998**	0.816**	1								
KEU	0.942**	0.875**	0.996**	-0.009 NS	-0.237 NS	0.844**	0.995**	0.834**	1							
NIE	-0.167 NS	-0.165 NS	-0.092 NS	0.777**	0.179 NS	-0.167 NS	-0.098 NS	-0.167 NS	-0.119 NS	1						
KIE	0.062 NS	0.116 NS	-0.082 NS	0.097 NS	0.896**	0.149 NS	-0.105 NS	0.129 NS	-0.098 NS	0.315 NS	1					
NER	-0.056 NS	-0.085 NS	0.15 NS	.0676*	-0.522 NS	-0.156 NS	0.165 NS	-0.151 NS	0.14 NS	0.656*	-0.275 NS	1				
KER	0.351 NS	0.344 NS	0.152 NS	-0.204 NS	0.783**	0.387 NS	0.113 NS	0.372 NS	0.139 NS	-0.046 NS	0.828**	-0.45 NS 9	1			
LN	0.937**	0.825**	0.797**	-0.203 NS	0.276 NS	0.855**	0.787**	0.839**	0.792**	-0.267 NS	0.258 NS	-0.349 NS	0.585*	1		
LK	0.914**	0.783**	0.939**	0.141 NS	-0.285 NS	0.762**	0.962**	0.751**	0.947**	-0.054 NS	-0.218 NS	0.231 NS	-0.011 NS	0.744**	1	
NU	0.987**	0.865**	0.891**	-0.143 NS	0.101 NS	0.880**	0.887**	0.864**	0.886**	-0.236 NS	0.122 NS	-0.203 NS	0.438 NS	0.977**	0.851**	1
KU	0.985**	0.863**	0.960**	-0.007 NS	-0.128 NS	0.856**	0.971**	0.841**	0.961**	-0.152 NS	-0.067 NS	0.033 NS	0.193 NS	0.878**	0.966**	0.954**

SCY: Seed cotton yield
NAE:Nitrogen agronomic efficiency:
KAE: Potassium agronomic efficiency:
NPE: Nitrogen physiological efficiency
KPE: Potassium physiological efficiency
NARE:Nitrogen apparent recovery efficiency
KARE : Potassium apparent recovery efficiency
NEU : Nitrogen utilization efficiency
KEU : Potassium utilization efficiency
NIE : Nitrogen internal utilization efficiency
KIE : Potassium internal utilization efficiency
NER : Nitrogen efficiency ratio
KER : Potassium efficiency ratio
LN : Leaf nitrogen concentration
LK : Leaf Potassium concentration
NU : Total nitrogen uptake
KU : Total potassium uptake
NS = Non-significant
***= Highly significant at p ⩽ 0.01;*
** = Significant at p ⩽0.05*



Supplementary Figure S1 Correlation between water use efficiency and nitrogen and potassium uptake of cultivars under varied irrigation levels



Supplementary Figure S2 Correlation between water use efficiency and nitrogen and potassium uptake of cultivars.