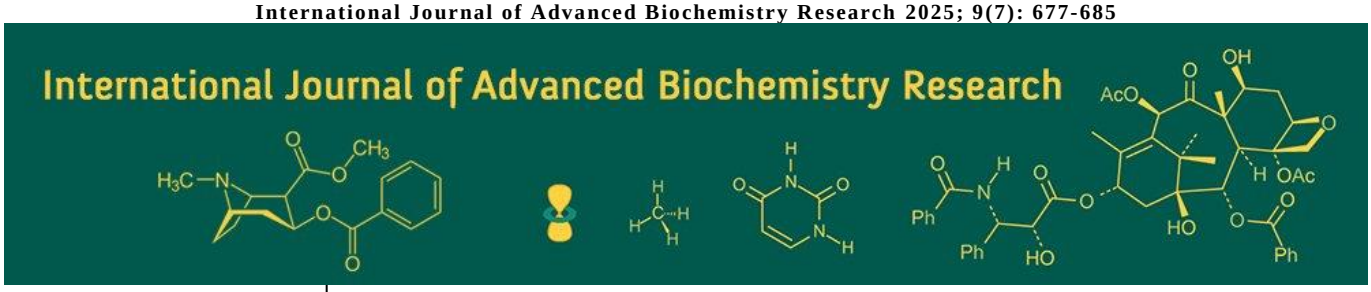

ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating: 5.29
IJABR 2025; 9(7): 677-685
www.biochemjournal.com
Received: 02-05-2025
Accepted: 06-06-2025

Srinivasa KM
M.Sc. Student, Department of Vegetable Science, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya, Uttar Pradesh, India

Ashish Kumar Singh
Assistant Professor, Department of Vegetable Science, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya, Uttar Pradesh, India

Nimit Singh
Research Scholar, Department of Vegetable Science, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya, Uttar Pradesh, India

Thokchom Premeshwori Devi
M.Sc. Student, Department of Vegetable Science, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya, Uttar Pradesh, India

Corresponding Author:
Srinivasa KM
M.Sc. Student, Department of Vegetable Science, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya, Uttar Pradesh, India

Studies on correlation and path analysis of yield attributes in cucumber (*Cucumis sativus* L.)

Srinivasa KM, Ashish Kumar Singh, Nimit Singh and Thokchom Premeshwori Devi

DOI: https://www.doi.org/10.33545/26174693.2025.v9.i7i.4818

Abstract
The present investigation was carried out to assess the correlation and path coefficient analysis for fruit yield and its component traits in 26 cucumber **(***Cucumis sativus* L.) genotypes evaluated during Summer and *Kharif* seasons (2024). The experiment was laid out in a Randomized Block Design (RBD) with three replications. Observations were recorded on 18 quantitative and qualitative traits. Significant genotypic and phenotypic correlations were observed among the traits in both seasons and in the pooled data. Fruit yield per plant and fruit yield per hectare exhibited strong positive genotypic correlations with average fruit weight, number of seed per fruit, number of fruits per plant, fruit length, fruit diameter, and number of primary branches per plant across seasons. In the pooled data, average fruit weight had a highly significant and positive correlation with average fruit weight (r = 0.915**), and fruit length (r = 0.913**). Genotypic and phenotypic path coefficient analysis revealed that fruit yield per plant had a strong and significant direct positive effect on Fruit yield (q/ha) across all seasons. Among individual traits, fruit length, average fruit weight, and number of seeds per fruit consistently showed high direct positive effects on yield in all three analyses. In the Kharif season, genotypic path analysis showed the highest direct effects from average fruit weight (0.8491) and number of fruits per plant (0.0485), whereas phenotypically, average fruit weight (0.5249) and number of fruits per plant (0.0226) were most influential. During the Summer season, average fruit weight, number of fruits per plant, number of seed per fruit showed the highest direct phenotypic effects on FYH, with supporting genotypic effects from internodal length and fruit length. The pooled analysis further validated these findings, with FL (0.920**), average fruit weight (0.915**), and number of seed per fruit (0.853**) contributing the most substantial direct effects genotypically. Traits such as vine length, number of fruits per plant, and fruit diameter also contributed positively but to a lesser degree. Conversely, traits like days to staminate flower anthesis, node number to first staminate flower appearance, and internodal length showed consistently negative direct effects on Fruit yield (q/ha) in all seaso.

Keywords: Genotypic correlation, phenotypic correlation and path analysis

Introduction
Cucumber (*Cucumis sativus* L.) is a significant vegetable crop belonging to the Cucurbitaceae family, widely cultivated across tropical and subtropical regions of India. It is primarily grown for its tender fruits, which are consumed in various forms raw in salads, cooked as a vegetable, or pickled during its immature stage (Sharma *et al.*, 2017) [9]. Nutritionally, cucumber serves as a good source of vitamins B and C, along with carbohydrates, calcium, and phosphorus (Yawalkar, 1985) [13]. The cucurbit family comprises about 118 genera and 825 species, with a major distribution in tropical and subtropical climates worldwide (Wang *et al.*, 2007) [12]. The domesticated cucumber (*Cucumis sativus* L.) is believed to have originated from its wild ancestor, *Cucumis hardwickii*, native to the Himalayan region of the Indo-China area, with India recognized as the primary centre of origin. Today, cucumber is widely cultivated under a broad range of agroclimatic conditions, from tropical lowlands to subtropical zones around the globe.
Understanding the direct and indirect effects of different traits on yield is crucial for breeders in identifying high-yielding parents for hybridization programs. To select superior parents effectively, breeders must examine both phenotypic and genotypic correlation coefficients of individual traits. Correlation analysis helps reveal how various traits influence yield, either directly or indirectly.

Path coefficient analysis further enhances this understanding by breaking down correlation coefficients into direct and indirect effects, thereby clarifying the specific contribution of each independent trait to the dependent trait, i.e., yield. This analytical approach compels researchers to clearly define the interrelationships among traits, fostering the development of logical and well-structured hypotheses about the factors influencing yield. With this perspective, the present study was undertaken to evaluate the associations among different traits and fruit yield per plant in cucumber, and to analyse the direct and indirect effects of these traits on yield.

Materials and Methods

The experimental material consisted of twenty-six cucumber genotypes, out of which twenty-five were collected from ANDUAT, Kumarganj, and one genotype (Pusa Uday) was sourced from IARI, New Delhi. These genotypes were evaluated to assess genetic variability and trait performance.

The site of investigation was Main Experiment Station, Department of Vegetable Science, Acharya Narendra Deva University of Agriculture and Technology, Narendra Nagar (Kumarganj), Ayodhya (U.P.) which is geographically located between 26.56 ° north latitude 81.84 ° east latitude. The altitude is about 113 meters above the mean sea level. The final experimental material comprising 26 genotypes (25 genotype + 1 check variety) were sown in Randomized Block Design (RBD) with three replications Pusa Uday used as a check variety during Summer and *Kharif* (2024). Each treatment consisted of twelve plants in two rows having spacing of 2 × 0.4 m with plot size 4 x 2meter square, All the cultural practices were adopted and fertilizer were given as per recommendations for good growth and stand of the crop as and when required.

Results and Discussion

Correlation studies

Correlation analysis across *Kharif* seasons, Summer seasons, and pooled revealed consistent and significant associations between several traits and yield in cucumber. Earliness traits such as days to staminate flower anthesis (DSFA) showed negative and significant genotypic correlations with FYP and FYH in all seasons:-0.073 and-0.157 (Summer),-0.376** and-0.379** (*Kharif*),-0.329** and-0.352** (phenotypic pooled), and-0.360** and-0.382** (genotypic pooled), respectively. Similarly, days to pistillate flower anthesis (DSPFA) correlated negatively with yield:-0.176 and-0.205 (Summer),-0.280* and-0.304** (*Kharif*),-0.285* and-0.290* (phenotypic pooled), and-0.299** and-0.321** (genotypic pooled), indicating that earlier flowering enhances productivity. Node number to first staminate flower appearance (NNFSFA) had strong and significant negative correlations with FYP and FYH:-0.263* and-0.260* (Summer),-0.501** and-0.499** (*Kharif*),-0.570** and-0.572** (phenotypic pooled), and-0.646** and-0.637** (genotypic pooled), supporting its use as a key selection trait for earliness. Vine length (VL) consistently showed significant positive correlations: 0.432** and 0.447** (Summer), 0.610** and 0.615** (*Kharif*), 0.470** and 0.481** (phenotypic pooled), and 0.546** and 0.554** (genotypic pooled), confirming that vigorous vine growth enhances yield through better canopy and photosynthesis. Plant branches per plant (PBP) also contributed positively: 0.479** and 0.510** (Summer), 0.357** and 0.360** (*Kharif*), 0.207* and 0.227* (phenotypic pooled), and 0.261* and 0.274* (genotypic pooled). Internode length (IL) exhibited negative correlations across all datasets:-0.199 and-0.168 (Summer),-0.351** and-0.353** (*Kharif*),-0.239* and-0.216 (phenotypic pooled), and-0.388** and-0.379** (genotypic pooled), indicating that compact plant types may enhance yield through efficient resource use.

Among yield components, fruit length (FL) showed strong positive genotypic correlations: 0.652** and 0.680** (Summer), 0.892** and 0.887** (*Kharif*), 0.586** and 0.590** (phenotypic pooled), and 0.901** and 0.920** (genotypic pooled), highlighting it as a major yield determinant. Fruit diameter (FD) also showed significant positive associations: 0.661** and 0.733** (Summer), 0.428** and 0.432** (*Kharif*), 0.348** and 0.337** (phenotypic pooled), and 0.471** and 0.486** (genotypic pooled). Average fruit weight (AFW) emerged as the most influential trait with correlations of 0.875** and 0.838** (Summer), 0.896** and 0.893** (*Kharif*), 0.831** and 0.843** (phenotypic pooled), and 0.909** and 0.915** (genotypic pooled). Number of fruits per plant (NFP) was also positively associated: 0.600** and 0.641** (Summer), 0.648** and o.648** (*Kharif*), 0.503** and 0.472** (phenotypic pooled), and 0.510** and 0.506** (genotypic pooled). Number of seeds per fruit (NSF) maintained strong and significant correlations: 0.550** and 0.644** (Summer), 0.896** and 0.893** (*Kharif*), 0.754** and 0.782** (phenotypic pooled), and 0.830** and 0.853** (genotypic pooled), suggesting its indirect role via fruit size and maturity. Quality traits like total soluble solids (TSS) showed weak to moderate positive correlations:-0.162 and-0.054 (Summer), 0.273* and 0.271* (*Kharif*), 0.266* and 0.271* (phenotypic pooled), and 0.281* and 0.291* (genotypic pooled), suggesting potential for simultaneous yield and quality improvement. Dry matter (DM) also correlated positively: 0.365** and 0.360** (Summer), 0.421** and 0.412** (*Kharif*), 0.443** and 0.439** (phenotypic pooled), and 0.519** and 0.506** (genotypic pooled). Ascorbic acid (AA) showed weak and non-significant correlations across seasons, e.g.,-0.106 and-0.183 (Summer), 0.105 and 0.107 (*Kharif*), 0.041 and 0.028 (phenotypic pooled), and 0.070 and 0.045 (genotypic pooled), indicating its independence from yield traits.

Fruit yield per plant (FYP) and fruit yield per hectare (FYH) were very highly correlated in all datasets, with values of 0.998** (Summer), 0.998** (*Kharif*), 0.986** (phenotypic pooled), and 0.997** (genotypic pooled), establishing FYP as a reliable proxy for yield assessment. Similar findings are also reported by Kaur *et al.*, (2022) in cucumber and Kumar *et al.*, 2018 in cucumber. Overall, traits such as AFW, FL, FD, NFP, NSF, VL, and PBP emerged as stable and strong contributors to yield across seasons, providing clear targets for selection in cucumber improvement programs.

Genotypic correlations

Table 1: Estimates of phenotypic and genotypic correlation coefficients among eighteen characters in cucumber (Summer)

Chrs	DSFA	DSPFA	NNFSFA	NNFPFA	VL	PBP	IL	DFFH	FL	FD	AFW	NFP	NSF	TSS	DM	AA	FYP (kg)	FYH (Q)
DSFA	1.000	0.841**	0.423**	-0.285*	-0.494**	-0.364**	0.159	-0.039	-0.024	-0.148	-0.098	0.056	-0.376**	-0.218	0.124	0.119	-0.073	-0.157
DSPFA			0.464**	-0.262*	-0.450**	-0.346**	0.124	-0.224*	-0.019	-0.004	-0.100	-0.210	-0.212	0.044	0.170	0.071	-0.176	-0.205
NNFSFA				0.236*	-0.433**	-0.144	0.214	-0.464**	-0.134	-0.068	-0.570**	0.203	-0.399**	-0.362**	-0.278*	0.126	-0.263*	-0.260*
NNFPFA					0.102	0.289*	0.171	-0.203	0.122	0.001	-0.129	-0.150	0.115	-0.275*	-0.283*	-0.096	-0.150	-0.008
VL						0.531**	-0.462**	0.347**	0.431**	0.320**	0.492**	0.255*	0.496**	0.026	0.242*	-0.505**	0.432**	0.447**
PBP							0.023	0.025	0.229*	0.533**	0.343**	0.469**	0.588**	-0.115	-0.124	-0.556**	0.479**	0.510**
IL								-0.114	-0.546**	-0.066	-0.336**	0.272*	-0.328**	-0.030	-0.204	0.013	-0.199	-0.168
DFFH									-0.055	-0.140	0.057	-0.072	-0.053	0.166	0.167	-0.497**	-0.063	-0.090
FL										0.528**	0.574**	0.366**	0.530**	0.088	0.392**	-0.170	0.652**	0.680**
FD											0.522**	0.383**	0.454**	0.191	0.253*	-0.182	0.661**	0.733**
AFW												0.071	0.613**	0.081	0.507**	-0.155	0.875**	0.838**
NFP													0.014	-0.372**	0.030	-0.200	0.600**	0.641**
NSF														0.207	0.095	-0.402**	0.550**	0.644**
TSS															0.303**	0.025	-0.162	-0.054
DM																0.054	0.365**	0.360**
AA																	-0.106	-0.183
FYP (kg)																		0.998**
FYH (Q)																		1.000

Phenotypic correlations

Chrs	DSFA	DSPFA	NNFSFA	NNFPFA	VL	PBP	IL	DFFH	FL	FD	AFW	NFP	NSF	TSS	DM	AA	FYP (kg)	FYH (Q)
DSFA	1.000	0.833**	0.388**	-0.263*	-0.472**	-0.329**	0.094	-0.031	-0.030	-0.152	-0.094	0.050	-0.354**	-0.211	0.107	0.082	-0.050	-0.131
DSPFA			0.433**	-0.250*	-0.432**	-0.320**	0.072	-0.205	-0.018	-0.006	-0.102	-0.091	-0.195	0.026	0.140	0.049	-0.137	-0.183
NNFSFA				0.200	-0.385**	-0.120	0.181	-0.438**	-0.092	-0.049	-0.449**	0.088	-0.359**	-0.326**	-0.230*	0.133	-0.248*	-0.246*
NNFPFA					0.052	0.248*	0.100	-0.179	0.113	0.045	-0.079	-0.085	0.101	-0.257*	-0.212	-0.083	-0.126	-0.026
VL						0.469**	-0.289*	0.299**	0.335**	0.245*	0.353**	0.076	0.406**	0.050	0.176	-0.409**	0.340**	0.398**
PBP							0.070	0.028	0.168	0.417**	0.262*	0.254*	0.465**	-0.079	-0.145	-0.441**	0.389**	0.462**
IL								-0.113	-0.366**	-0.028	-0.193	0.099	-0.191	0.020	-0.148	0.042	-0.130	-0.139
DFFH									-0.046	-0.117	0.066	-0.042	-0.044	0.139	0.139	-0.450**	-0.061	-0.083
FL										0.376**	0.376**	0.194	0.470**	0.073	0.325**	-0.138	0.493**	0.549**
FD											0.332**	0.230*	0.357**	0.136	0.208	-0.127	0.496**	0.588**
AFW												-0.015	0.435**	0.058	0.470**	-0.068	0.655**	0.696**
NFP													0.007	-0.271*	0.012	-0.163	0.516**	0.390**
NSF														0.152	0.085	-0.351**	0.434**	0.562**
TSS															0.255*	0.012	-0.129	-0.054
DM																0.083	0.264*	0.295**
AA																	-0.131	-0.165
FYP (kg)																		0.893**
FYH (Q)																		1.000

*, ** significant at 5% and 1% level, respectively

Genotypic correlation

Table 2: Estimates of phenotypic and genotypic correlation coefficients among eighteen characters in cucumber (*Kharif*)

Chrs	DSFA	DSPFA	NNFSFA	NNFPFA	VL	PBP	IL	DFFH	FL	FD	AFW	NFP	NSF	TSS	DM	AA	FYP (kg)	FYH (Q)
DSFA	1.000	0.935**	0.498**	-0.183	-0.447**	-0.504**	0.164	0.996**	-0.345**	-0.138	-0.154	-0.595**	-0.155	-0.187	0.042	0.119	-0.376**	-0.379**
DSPFA			0.366**	-0.317**	-0.457**	-0.393**	0.116	1.018**	-0.164	-0.049	-0.103	-0.541**	-0.104	-0.070	0.063	0.138	-0.285*	-0.290*
NNFSFA				0.349**	-0.356**	-0.260*	0.381**	0.484**	-0.447**	-0.246*	-0.253*	-0.641**	-0.251*	-0.120	-0.308**	0.091	-0.501**	-0.499**
NNFPFA					0.178	-0.358**	0.089	-0.196	-0.190	0.143	-0.147	-0.030	-0.147	-0.376**	-0.211	-0.146	-0.174	-0.167
VL						0.548**	-0.371**	-0.520**	0.478**	0.309**	0.478**	0.483**	0.480**	0.099	0.037	-0.005	0.610**	0.615**
PBP							0.181	-0.563**	0.449**	0.281*	0.261*	0.279*	0.263*	0.515**	0.040	-0.015	0.357**	0.360**
IL								0.201	-0.061	0.142	-0.132	-0.496**	-0.131	0.332**	-0.080	0.246*	-0.351**	-0.353**
DFFH									-0.224*	-0.039	-0.125	-0.606**	-0.126	-0.183	-0.036	0.173	-0.339**	-0.343**
FL										0.411**	0.780**	0.545**	0.781**	0.373**	0.304**	-0.247*	0.892**	0.887**
FD											0.175	0.643**	0.176	0.150	0.549**	0.216	0.428**	0.432**
AFW												0.223*	1.000**	0.262*	0.245*	0.125	0.896**	0.893**
NFP													0.223*	0.118	0.504**	-0.059	0.648**	0.648**
NSF														0.262*	0.245*	0.127	0.896**	0.893**
TSS															0.259*	0.169	0.273*	0.271*
DM																0.058	0.421**	0.412**
AA																	0.105	0.107
FYP (kg)																		0.998**
FYH (Q)																		1.000

Phenotypic correlation

Traits	DSFA	DSPFA	NNFSFA	NNFPFA	VL	PBP	IL	DFFH	FL	FD	AFW	NFP	NSF	TSS	DM	AA	FYP (kg)	FYH (Q)
DSFA	1.000	0.928**	0.435**	-0.183	-0.360**	-0.424**	0.080	0.836**	-0.197	-0.125	-0.136	-0.448**	-0.137	-0.172	0.039	0.117	-0.342**	-0.345**
DSPFA			0.320**	-0.310**	-0.367**	-0.341**	0.058	0.865**	-0.064	-0.058	-0.093	-0.422**	-0.094	-0.066	0.058	0.144	-0.271*	-0.275*
NNFSFA				0.322**	-0.313**	-0.164	0.199	0.355**	-0.319**	-0.213	-0.238*	-0.423**	-0.238*	-0.111	-0.272*	0.065	-0.434**	-0.433**
NNFPFA					0.057	-0.209	0.075	-0.174	-0.086	0.130	-0.107	-0.044	-0.107	-0.337**	-0.183	-0.145	-0.137	-0.132
VL						0.378**	-0.112	-0.360**	0.292**	0.166	0.355**	0.400**	0.356**	0.109	0.021	0.002	0.490**	0.494**
PBP							0.089	-0.403**	0.367**	0.136	0.216	0.254*	0.218	0.389**	0.022	-0.015	0.278*	0.288*
IL								0.097	-0.014	0.050	-0.061	-0.126	-0.061	0.227*	-0.079	0.173	-0.146	-0.142
DFFH									-0.175	-0.084	-0.113	-0.362**	-0.113	-0.157	0.012	0.166	-0.273*	-0.279*
FL										0.230*	0.596**	0.255*	0.596**	0.251*	0.219	-0.161	0.607**	0.606**
FD											0.094	0.339**	0.094	0.138	0.350**	0.163	0.302**	0.294**
AFW												0.145	0.998**	0.232*	0.219	0.123	0.821**	0.823**
NFP													0.146	0.099	0.365**	-0.073	0.616**	0.618**
NSF														0.233*	0.221	0.125	0.822**	0.823**
TSS															0.229*	0.157	0.255*	0.254*
DM																0.052	0.372**	0.367**
AA																	0.088	0.091
FYP (kg)																		0.997**
FYH (Q)																		1.000

*, ** significant at 5% and 1% level, respectively

Genotypic correlation

Table 3: Estimates of phenotypic and genotypic correlation coefficients among eighteen characters in cucumber (Pooled data)

Chrs	DSFA	DSPFA	NNFSFA	NNFPFA	VL	PBP	IL	DFFH	FL	FD	AFW	NFP	NSF	TSS	DM	AA	FYP (kg)	FYH (Q)
DSFA	1.000	0.923**	0.475**	-0.231*	-0.539**	-0.589**	0.157	0.728**	-0.333**	-0.185	-0.167	-0.479**	-0.317**	-0.196	0.086	0.115	-0.360**	-0.382**
DSPFA			0.443**	-0.299**	-0.545**	-0.557**	0.126	0.674**	-0.196	-0.192	-0.081	-0.586**	-0.199	-0.001	0.125	0.078	-0.299**	-0.321**
NNFSFA				0.310**	-0.516**	-0.253*	0.288*	0.051	-0.583**	-0.310**	-0.441**	-0.630**	-0.438**	-0.221	-0.306**	0.091	-0.646**	-0.637**
NNFPFA					0.140	-0.153	0.125	-0.295**	-0.093	0.125	-0.165	-0.104	-0.060	-0.331**	-0.245*	-0.133	-0.212	-0.161
VL						0.615**	-0.485**	-0.162	0.622**	0.313**	0.364**	0.594**	0.386**	0.057	0.165	-0.279*	0.546**	0.554**
PBP							0.129	-0.292**	0.367**	0.366**	0.037	0.521**	0.138	0.404**	-0.031	-0.268*	0.261*	0.274*
IL								0.013	-0.365**	0.014	-0.262*	-0.167	-0.312**	0.165	-0.145	0.146	-0.388**	-0.379**
DFFH									0.068	0.027	-0.062	-0.298**	-0.204	-0.112	0.097	-0.172	-0.155	-0.197
FL										0.524**	0.813**	0.460**	0.796**	0.503**	0.593**	-0.387**	0.901**	0.920**
FD											0.184	0.693**	0.157	0.261*	0.628**	0.061	0.471**	0.486**
AFW												0.092	0.907**	0.288*	0.388**	0.075	0.909**	0.915**
NFP													0.102	0.045	0.466**	-0.147	0.510**	0.506**
NSF														0.294**	0.243*	-0.105	0.830**	0.853**
TSS															0.275*	0.129	0.281*	0.291**
DM																0.060	0.519**	0.506**
AA																	0.070	0.045
FYP (kg)																		0.997**
FYH (Q)																		1.000

Phenotypic correlation

Chrs	DSFA	DSPFA	NNFSFA	NNFPFA	VL	PBP	IL	DFFH	FL	FD	AFW	NFP	NSF	TSS	DM	AA	FYP (kg)	FYH (Q)
DSFA	1.000	0.918**	0.437**	-0.221	-0.489**	-0.511**	0.099	0.655**	-0.202	-0.180	-0.154	-0.332**	-0.292**	-0.185	0.075	0.109	-0.329**	-0.352**
DSPFA			0.413**	-0.292**	-0.488**	-0.476**	0.075	0.615**	-0.108	-0.175	-0.078	-0.413**	-0.187	-0.003	0.107	0.080	-0.280*	-0.304**
NNFSFA				0.282*	-0.448**	-0.200	0.224*	0.037	-0.436**	-0.252*	-0.422**	-0.390**	-0.403**	-0.205	-0.270*	0.078	-0.570**	-0.572**
NNFPFA					0.063	-0.078	0.091	-0.254*	-0.016	0.142	-0.133	-0.121	-0.038	-0.307**	-0.199	-0.133	-0.194	-0.150
VL						0.457**	-0.261*	-0.131	0.384**	0.215	0.280*	0.386**	0.294**	0.081	0.114	-0.234*	0.470**	0.481**
PBP							0.086	-0.232*	0.305**	0.258*	0.061	0.327**	0.138	0.329**	-0.048	-0.221	0.207	0.227*
IL								0.012	-0.222	0.046	-0.198	-0.111	-0.196	0.159	-0.121	0.118	-0.239*	-0.216
DFFH									0.056	0.004	-0.050	-0.171	-0.184	-0.115	0.108	-0.134	-0.147	-0.176
FL										0.272*	0.586**	0.175	0.577**	0.313**	0.403**	-0.260*	0.586**	0.590**
FD											0.122	0.377**	0.102	0.215	0.435**	0.052	0.348**	0.337**
AFW												0.094	0.871**	0.255*	0.380**	0.078	0.831**	0.843**
NFP													0.110	0.014	0.320**	-0.149	0.503**	0.472**
NSF														0.245*	0.217	-0.096	0.754**	0.782**
TSS															0.239*	0.115	0.266*	0.271*
DM																0.061	0.443**	0.439**
AA																	0.041	0.028
FYP (kg)																		0.986**
FYH (Q)																		1.000

*, ** significant at 5% and 1% level, respectively

DSFA: Day to staminate flower anthesis, DSPFA: Days to first pistillate flower anthesis, NNFSFA: Node number to first staminate flower appearance, NNFPFA: Node number to first pistillate flower appearance, VL: Vine length(m), PBP: Primary branches per plant, IL: Internodal length (cm), DFFH: Days to first fruit harvest, FL: Fruit length (cm), FD: Fruit diameter (cm), AFW: Average fruit weight (g), NFP: Number of fruit per plant, NSF: Number of seed/fruit, TSS: T.S.S (°Brix), DM: Dry matter (%), AA: Ascorbic acid (mg/100g), FYP (kg): Fruit yield per plant(Kg), FYH (Q): Fruit yield (q/ha).

Genotypic path with fruit yield (q/ha)

Table 4: Estimates of direct and indirect effects of eighteen characters on yield (q/ha) in cucumber (Summer)

Chrs	DSFA	DSPFA	NNFSFA	NNFPFA	VL	PBP	IL	DFFH	FL	FD	AFW	NFP	NSF	TSS	DM	AA	FYP (kg)	FYH (Q)
DSFA	0.1223	-0.3421	0.1273	0.0733	-0.0664	0.0136	0.0683	-0.0003	-0.0095	-0.0239	-0.0207	-0.0119	-0.0876	0.0248	0.0029	0.0053	-0.0326	-0.157
DSPFA	0.1028	-0.4069	0.1394	0.0674	-0.0606	0.0130	0.0531	-0.0018	-0.0077	-0.0007	-0.0211	0.0443	-0.0495	-0.0050	0.0040	0.0032	-0.0785	-0.205
NNFSFA	0.0518	-0.1887	0.3005	-0.0607	-0.0583	0.0054	0.0917	-0.0037	-0.0531	-0.0110	-0.1207	-0.0429	-0.0930	0.0413	-0.0066	0.0057	-0.1174	-0.260*
NNFPFA	-0.0348	0.1065	0.0709	-0.2575	0.0137	-0.0108	0.0731	-0.0016	0.0484	0.0002	-0.0273	0.0316	0.0269	0.0314	-0.0067	-0.0043	-0.0671	-0.008
VL	-0.0603	0.1832	-0.1302	-0.0262	0.1346	-0.0199	-0.1981	0.0027	0.1704	0.0516	0.1042	-0.0537	0.1156	-0.0030	0.0057	-0.0226	0.1932	0.447**
PBP	-0.0445	0.1408	-0.0434	-0.0744	0.0715	-0.0375	0.0100	0.0002	0.0908	0.0859	0.0728	-0.0989	0.1372	0.0131	-0.0029	-0.0249	0.2140	0.510**
IL	0.0195	-0.0504	0.0643	-0.0440	-0.0622	-0.0009	0.4284	-0.0009	-0.2162	-0.0107	-0.0711	-0.0574	-0.0767	0.0034	-0.0048	0.0006	-0.0887	-0.168
DFFH	-0.0047	0.0912	-0.1396	0.0524	0.0467	-0.0009	-0.0489	0.0079	-0.0218	-0.0226	0.0122	0.0153	-0.0123	-0.0190	0.0039	-0.0222	-0.0281	-0.090
FL	-0.0030	0.0079	-0.0403	-0.0315	0.0580	-0.0086	-0.2341	-0.0004	0.3957	0.0851	0.1216	-0.0772	0.1237	-0.0101	0.0093	-0.0076	0.2913	0.680**
FD	-0.0182	0.0017	-0.0206	-0.0003	0.0431	-0.0200	-0.0284	-0.0011	0.2089	0.1611	0.1106	-0.0809	0.1060	-0.0218	0.0060	-0.0081	0.2953	0.733**
AFW	-0.0120	0.0406	-0.1712	0.0332	0.0662	-0.0129	-0.1438	0.0005	0.2271	0.0841	0.2119	-0.0149	0.1430	-0.0092	0.0120	-0.0069	0.3908	0.838**
NFP	0.0069	0.0854	0.0611	0.0386	0.0342	-0.0176	0.1166	-0.0006	0.1447	0.0617	0.0150	-0.2111	0.0033	0.0424	0.0007	-0.0090	0.2680	0.641**
NSF	-0.0459	0.0864	-0.1198	-0.0297	0.0667	-0.0220	-0.1407	-0.0004	0.2098	0.0732	0.1298	-0.0030	0.2334	-0.0236	0.0023	-0.0180	0.2459	0.644**
TSS	-0.0266	-0.0177	-0.1089	0.0709	0.0035	0.0043	-0.0129	0.0013	0.0350	0.0308	0.0171	0.0786	0.0484	-0.1139	0.0072	0.0011	-0.0726	-0.054
DM	0.0152	-0.0691	-0.0836	0.0728	0.0326	0.0047	-0.0875	0.0013	0.1552	0.0407	0.1073	-0.0063	0.0222	-0.0345	0.0236	0.0024	0.1629	0.360**
AA	0.0145	-0.0290	0.0379	0.0247	-0.0679	0.0208	0.0054	-0.0039	-0.0674	-0.0293	-0.0328	0.0422	-0.0939	-0.0028	0.0013	0.0447	-0.0476	-0.183
FYP (kg)	-0.0089	0.0715	-0.0790	0.0387	0.0582	-0.0179	-0.0850	-0.0005	0.2580	0.1065	0.1853	-0.1266	0.1284	0.0185	0.0086	-0.0048	0.4468	0.998**

Resi-0.00114 *, ** significant at 5% and 1% level, respectively

Phenotypic path with fruit yield (q/ha)

Chrs	DSFA	DSPFA	NNFSFA	NNFPFA	VL	PBP	IL	DFFH	FL	FD	AFW	NFP	NSF	TSS	DM	AA	FYP (kg)	FYH (Q)
DSFA	0.2334	-0.2333	0.0353	0.0001	-0.0210	-0.0030	0.0009	0.0023	-0.0009	-0.0261	-0.0186	0.0010	-0.0658	-0.0092	0.0030	-0.0014	-0.0274	-0.131
DSPFA	0.1943	-0.2802	0.0394	0.0001	-0.0192	-0.0030	0.0007	0.0150	-0.0006	-0.0011	-0.0201	-0.0018	-0.0363	0.0012	0.0039	-0.0009	-0.0744	-0.183
NNFSFA	0.0906	-0.1213	0.0910	-0.0001	-0.0172	-0.0011	0.0017	0.0321	-0.0029	-0.0084	-0.0884	0.0017	-0.0668	-0.0142	-0.0064	-0.0023	-0.1344	-0.246*
NNFPFA	-0.0614	0.0702	0.0182	-0.0004	0.0023	0.0023	0.0009	0.0131	0.0035	0.0078	-0.0155	-0.0017	0.0187	-0.0112	-0.0059	0.0015	-0.0682	-0.026
VL	-0.1102	0.1209	-0.0351	0.0000	0.0445	0.0043	-0.0027	-0.0219	0.0104	0.0421	0.0694	0.0015	0.0756	0.0022	0.0049	0.0072	0.1844	0.398**
PBP	-0.0768	0.0896	-0.0109	-0.0001	0.0209	0.0092	0.0006	-0.0020	0.0052	0.0716	0.0516	0.0050	0.0866	-0.0035	-0.0040	0.0078	0.2111	0.462**
IL	0.0219	-0.0201	0.0165	0.0000	-0.0129	0.0007	0.0092	0.0083	-0.0113	-0.0049	-0.0379	0.0020	-0.0357	0.0009	-0.0041	-0.0008	-0.0705	-0.139
DFFH	-0.0072	0.0575	-0.0398	0.0001	0.0133	0.0003	-0.0010	-0.0733	-0.0014	-0.0202	0.0130	-0.0008	-0.0083	0.0061	0.0039	0.0079	-0.0329	-0.083
FL	-0.0070	0.0051	-0.0084	-0.0001	0.0149	0.0016	-0.0034	0.0033	0.0310	0.0645	0.0740	0.0038	0.0876	0.0032	0.0090	0.0024	0.2678	0.549**
FD	-0.0354	0.0018	-0.0045	0.0000	0.0109	0.0039	-0.0003	0.0086	0.0116	0.1717	0.0653	0.0045	0.0666	0.0060	0.0058	0.0022	0.2694	0.588**
AFW	-0.0221	0.0286	-0.0409	0.0000	0.0157	0.0024	-0.0018	-0.0048	0.0116	0.0569	0.1968	-0.0003	0.0810	0.0025	0.0131	0.0012	0.3557	0.696**
NFP	0.0116	0.0255	0.0080	0.0000	0.0034	0.0023	0.0009	0.0031	0.0060	0.0394	-0.0030	0.0197	0.0013	-0.0119	0.0003	0.0029	0.2803	0.390**
NSF	-0.0825	0.0546	-0.0327	0.0000	0.0181	0.0043	-0.0018	0.0033	0.0146	0.0614	0.0856	0.0001	0.1862	0.0066	0.0024	0.0062	0.2358	0.562**
TSS	-0.0492	-0.0074	-0.0296	0.0001	0.0022	-0.0007	0.0002	-0.0102	0.0023	0.0234	0.0114	-0.0053	0.0283	0.0437	0.0071	-0.0002	-0.0702	-0.054
DM	0.0250	-0.0391	-0.0210	0.0001	0.0078	-0.0013	-0.0014	-0.0102	0.0101	0.0357	0.0925	0.0002	0.0159	0.0111	0.0278	-0.0015	0.1433	0.295**
AA	0.0192	-0.0138	0.0121	0.0000	-0.0182	-0.0041	0.0004	0.0330	-0.0043	-0.0218	-0.0134	-0.0032	-0.0653	0.0005	0.0023	-0.0176	-0.0710	-0.165
FYP (kg)	-0.0118	0.0384	-0.0225	0.0001	0.0151	0.0036	-0.0012	0.0044	0.0153	0.0852	0.1290	0.0102	0.0809	-0.0057	0.0073	0.0023	0.5429	0.893**

Resi-0.0139 *, ** significant at 5% and 1% level, respectively

Genotypic path with fruit yield (q/ha)

Table 5: Estimates of direct and indirect effects of eighteen characters on yield (q/ha) in cucumber (*Kharif*)

Chrs	DSFA	DSPFA	NNFSFA	NNFPFA	VL	PBP	IL	DFFH	FL	FD	AFW	NFP	NSF	TSS	DM	AA	FYP (kg)	FYH (Q)
DSFA	-0.0388	-0.0021	0.0085	0.0045	-0.0123	0.0087	0.0000	0.0267	0.0046	-0.0027	-0.1311	-0.0288	0.1180	-0.0007	-0.0005	-0.0006	-0.3325	-0.379**
DSPFA	-0.0363	-0.0022	0.0062	0.0079	-0.0126	0.0068	0.0000	0.0273	0.0022	-0.0009	-0.0876	-0.0262	0.0794	-0.0003	-0.0007	-0.0007	-0.2523	-0.290*
NNFSFA	-0.0193	-0.0008	0.0170	-0.0087	-0.0098	0.0045	-0.0001	0.0130	0.0060	-0.0048	-0.2151	-0.0311	0.1913	-0.0005	0.0034	-0.0004	-0.4434	-0.499**
NNFPFA	0.0071	0.0007	0.0059	-0.0248	0.0049	0.0062	0.0000	-0.0053	0.0025	0.0028	-0.1251	-0.0015	0.1121	-0.0014	0.0024	0.0007	-0.1541	-0.167
VL	0.0174	0.0010	-0.0060	-0.0044	0.0275	-0.0095	0.0001	-0.0140	-0.0064	0.0060	0.4056	0.0234	-0.3651	0.0004	-0.0004	0.0000	0.5399	0.615**
PBP	0.0195	0.0009	-0.0044	0.0089	0.0151	-0.0173	-0.0001	-0.0151	-0.0060	0.0054	0.2220	0.0135	-0.1998	0.0019	-0.0005	0.0001	0.3159	0.360**
IL	-0.0064	-0.0003	0.0065	-0.0022	-0.0102	-0.0031	-0.0003	0.0054	0.0008	0.0027	-0.1123	-0.0241	0.0994	0.0012	0.0009	-0.0012	-0.3103	-0.353**
DFFH	-0.0387	-0.0022	0.0082	0.0049	-0.0143	0.0097	-0.0001	0.0268	0.0030	-0.0008	-0.1060	-0.0294	0.0962	-0.0007	0.0004	-0.0008	-0.2997	-0.343**
FL	0.0134	0.0004	-0.0076	0.0047	0.0132	-0.0078	0.0000	-0.0060	-0.0134	0.0080	0.6620	0.0264	-0.5943	0.0014	-0.0034	0.0012	0.7890	0.887**
FD	0.0053	0.0001	-0.0042	-0.0035	0.0085	-0.0049	0.0000	-0.0011	-0.0055	0.0193	0.1486	0.0312	-0.1337	0.0006	-0.0061	-0.0010	0.3788	0.432**
AFW	0.0060	0.0002	-0.0043	0.0037	0.0131	-0.0045	0.0000	-0.0034	-0.0105	0.0034	0.8491	0.0108	-0.7612	0.0010	-0.0027	-0.0006	0.7930	0.893**
NFP	0.0231	0.0012	-0.0109	0.0007	0.0133	-0.0048	0.0001	-0.0163	-0.0073	0.0124	0.1892	0.0485	-0.1698	0.0004	-0.0056	0.0003	0.5737	0.648**
NSF	0.0060	0.0002	-0.0043	0.0037	0.0132	-0.0045	0.0000	-0.0034	-0.0105	0.0034	0.8491	0.0108	-0.7612	0.0010	-0.0027	-0.0006	0.7930	0.893**
TSS	0.0072	0.0002	-0.0020	0.0093	0.0027	-0.0089	-0.0001	-0.0049	-0.0050	0.0029	0.2221	0.0057	-0.1998	0.0037	-0.0029	-0.0008	0.2418	0.271*
DM	-0.0016	-0.0001	-0.0052	0.0052	0.0010	-0.0007	0.0000	-0.0010	-0.0041	0.0106	0.2077	0.0244	-0.1864	0.0010	-0.0111	-0.0003	0.3724	0.412**
AA	-0.0046	-0.0003	0.0016	0.0036	-0.0002	0.0003	-0.0001	0.0046	0.0033	0.0042	0.1060	-0.0029	-0.0967	0.0006	-0.0007	-0.0047	0.0933	0.107
FYP (kg)	0.0146	0.0006	-0.0085	0.0043	0.0168	-0.0062	0.0001	-0.0091	-0.0120	0.0083	0.7610	0.0314	-0.6821	0.0010	-0.0047	-0.0005	0.8829	0.998**

Resi-0.00015 *, ** significant at 5% and 1% level, respectively

Phenotypic path with fruit yield (q/ha)

Chrs	DSFA	DSPFA	NNFSFA	NNFPFA	VL	PBP	IL	DFFH	FL	FD	AFW	NFP	NSF	TSS	DM	AA	FYP (kg)	FYH (Q)
DSFA	0.0099	0.0080	-0.0031	-0.0027	-0.0001	-0.0067	0.0002	-0.0099	0.0004	0.0019	-0.0712	-0.0101	0.0688	0.0003	0.0000	0.0012	-0.3313	-0.345**
DSPFA	0.0092	0.0087	-0.0023	-0.0046	-0.0001	-0.0054	0.0001	-0.0102	0.0001	0.0009	-0.0488	-0.0095	0.0473	0.0001	-0.0001	0.0015	-0.2623	-0.275*
NNFSFA	0.0043	0.0028	-0.0072	0.0048	-0.0001	-0.0026	0.0004	-0.0042	0.0006	0.0032	-0.1251	-0.0096	0.1193	0.0002	0.0003	0.0007	-0.4207	-0.433**
NNFPFA	-0.0018	-0.0027	-0.0023	0.0149	0.0000	-0.0033	0.0002	0.0021	0.0002	-0.0020	-0.0563	-0.0010	0.0536	0.0006	0.0002	-0.0015	-0.1332	-0.132
VL	-0.0036	-0.0032	0.0023	0.0009	0.0003	0.0060	-0.0002	0.0043	-0.0006	-0.0025	0.1861	0.0091	-0.1788	-0.0002	0.0000	0.0000	0.4746	0.494**
PBP	-0.0042	-0.0030	0.0012	-0.0031	0.0001	0.0158	0.0002	0.0048	-0.0007	-0.0020	0.1135	0.0057	-0.1095	-0.0007	0.0000	-0.0002	0.2696	0.288*
IL	0.0008	0.0005	-0.0014	0.0011	0.0000	0.0014	0.0019	-0.0012	0.0000	-0.0008	-0.0322	-0.0029	0.0306	-0.0004	0.0001	0.0018	-0.1411	-0.142
DFFH	0.0083	0.0075	-0.0026	-0.0026	-0.0001	-0.0064	0.0002	-0.0118	0.0003	0.0013	-0.0593	-0.0082	0.0569	0.0003	0.0000	0.0018	-0.2643	-0.279*
FL	-0.0020	-0.0006	0.0023	-0.0013	0.0001	0.0058	0.0000	0.0021	-0.0019	-0.0034	0.3126	0.0058	-0.2993	-0.0004	-0.0003	-0.0017	0.5882	0.606**
FD	-0.0012	-0.0005	0.0015	0.0019	0.0001	0.0022	0.0001	0.0010	-0.0004	-0.0150	0.0493	0.0077	-0.0470	-0.0002	-0.0004	0.0017	0.2930	0.294**
AFW	-0.0013	-0.0008	0.0017	-0.0016	0.0001	0.0034	-0.0001	0.0013	-0.0012	-0.0014	0.5249	0.0033	-0.5020	-0.0004	-0.0003	0.0013	0.7957	0.823**
NFP	-0.0044	-0.0037	0.0031	-0.0007	0.0001	0.0040	-0.0002	0.0043	-0.0005	-0.0051	0.0763	0.0226	-0.0733	-0.0002	-0.0004	-0.0008	0.5970	0.618**
NSF	-0.0014	-0.0008	0.0017	-0.0016	0.0001	0.0035	-0.0001	0.0013	-0.0012	-0.0014	0.5248	0.0033	-0.5020	-0.0004	-0.0003	0.0013	0.7965	0.823**
TSS	-0.0017	-0.0006	0.0008	-0.0050	0.0000	0.0062	0.0004	0.0019	-0.0005	-0.0021	0.1219	0.0022	-0.1170	-0.0017	-0.0003	0.0017	0.2476	0.254*
DM	0.0004	0.0005	0.0020	-0.0027	0.0000	0.0004	-0.0002	-0.0002	-0.0004	-0.0052	0.1152	0.0083	-0.1109	-0.0004	-0.0011	0.0005	0.3607	0.367**
AA	0.0012	0.0012	-0.0005	-0.0022	0.0000	-0.0002	0.0003	-0.0020	0.0003	-0.0024	0.0647	-0.0017	-0.0630	-0.0003	-0.0001	0.0106	0.0850	0.091
FYP (kg)	-0.0034	-0.0023	0.0031	-0.0021	0.0001	0.0044	-0.0003	0.0032	-0.0012	-0.0045	0.4309	0.0139	-0.4126	-0.0004	-0.0004	0.0009	0.9692	0.997**

Resi-0.00214 *, ** significant at 5% and 1% level, respectively

Genotypic path with fruit yield (Q/HA)

Table 6: Estimates of direct and indirect effects of eighteen characters on yield (q/ha) in cucumber (Pooled)

Chrs	DSFA	DSPFA	NNFSFA	NNFPFA	VL	PBP	IL	DFFH	FL	FD	AFW	NFP	NSF	TSS	DM	AA	FYP (kg)	FYH (Q)
DSFA	0.8483	-0.3710	-0.3358	0.0077	0.0870	-0.2721	-0.0716	-0.5374	0.1836	-0.1718	-0.2943	0.3258	0.2324	0.0018	-0.0036	-0.0587	0.0473	-0.382**
DSPFA	0.7833	-0.4018	-0.3128	0.0099	0.0879	-0.2570	-0.0576	-0.4979	0.1079	-0.1787	-0.1429	0.3986	0.1460	0.0000	-0.0052	-0.0397	0.0392	-0.321**
NNFSFA	0.4031	-0.1778	-0.7068	-0.0103	0.0833	-0.1169	-0.1317	-0.0375	0.3218	-0.2888	-0.7777	0.4285	0.3208	0.0020	0.0127	-0.0464	0.0849	-0.637**
NNFPFA	-0.1957	0.1201	-0.2193	-0.0333	-0.0226	-0.0706	-0.0573	0.2179	0.0514	0.1168	-0.2917	0.0708	0.0439	0.0030	0.0102	0.0677	0.0279	-0.1610
VL	-0.4572	0.2189	0.3647	-0.0047	-0.1613	0.2839	0.2219	0.1197	-0.3430	0.2916	0.6424	-0.4037	-0.2829	-0.0005	-0.0069	0.1423	-0.0718	0.554**
PBP	-0.5000	0.2237	0.1790	0.0051	-0.0992	0.4617	-0.0591	0.2157	-0.2027	0.3405	0.0649	-0.3547	-0.1010	-0.0037	0.0013	0.1367	-0.0342	0.274*
IL	0.1328	-0.0506	-0.2035	-0.0042	0.0783	0.0597	-0.4572	-0.0096	0.2012	0.0129	-0.4631	0.1136	0.2289	-0.0015	0.0060	-0.0741	0.0510	-0.379**
DFFH	0.6172	-0.2708	-0.0359	0.0098	0.0262	-0.1348	-0.0059	-0.7386	-0.0376	0.0255	-0.1095	0.2027	0.1495	0.0010	-0.0040	0.0876	0.0204	-0.1970
FL	-0.0822	0.0786	0.4122	0.0031	-0.1003	0.1696	0.1667	-0.0504	-0.0518	0.4876	0.4337	-0.3128	-0.2836	-0.0046	-0.0246	0.1971	-0.1185	0.920**
FD	-0.1565	0.0771	0.2193	-0.0042	-0.0506	0.1689	-0.0064	-0.0202	-0.2890	0.9308	0.3239	-0.4713	-0.1149	-0.0024	-0.0261	-0.0309	-0.0619	0.486**
AFW	-0.0415	0.0325	0.3116	0.0055	-0.0588	0.0170	0.1200	0.0459	-0.1484	0.1709	0.7641	-0.0627	-0.0647	-0.0026	-0.0161	-0.0382	-0.1194	0.915**
NFP	-0.4064	0.2354	0.4452	0.0035	-0.0958	0.2408	0.0764	0.2201	-0.2538	0.6450	0.1626	-0.6801	-0.0748	-0.0004	-0.0193	0.0746	-0.0670	0.506**
NSF	-0.1689	0.0800	0.3093	0.0020	-0.0623	0.0636	0.1428	0.1507	-0.1393	0.1459	0.5996	-0.0694	-0.1330	-0.0027	-0.0101	0.0534	-0.1090	0.853**
TSS	-0.1660	0.0005	0.1565	0.0110	-0.0092	0.1864	-0.0756	0.0825	-0.2775	0.2433	0.5078	-0.0305	-0.2156	-0.0091	-0.0114	-0.0655	-0.0369	0.291**
DM	0.0727	-0.0503	0.2165	0.0082	-0.0266	-0.0142	0.0663	-0.0714	-0.3272	0.5843	0.6853	-0.3169	-0.1781	-0.0025	-0.0415	-0.0306	-0.0683	0.506**
AA	0.0978	-0.0313	-0.0644	0.0044	0.0451	-0.1239	-0.0666	0.1270	0.2135	0.0565	0.1323	0.0997	0.0768	-0.0012	-0.0025	-0.5094	-0.0091	0.0450
FYP (kg)	-0.1056	0.1200	0.4567	0.0071	-0.0881	0.1203	0.1774	0.1145	-0.1974	0.4384	0.6007	-0.3467	-0.1081	-0.0025	-0.0216	-0.0354	-0.1314	0.997**

Resi-0.0276 *, ** significant at 5% and 1% level, respectively

Phenotypic path with fruit yield per plant (kg)

Chrs	DSFA	DSPFA	NNFSFA	NNFPFA	VL	PBP	IL	DFFH	FL	FD	AFW	NFP	NSF	TSS	DM	AA	FYP (kg)	FYH (Q)
DSFA	0.0602	-0.0308	-0.0191	-0.0118	-0.0078	-0.0240	0.0019	-0.0159	0.0065	0.0047	0.0012	0.0118	-0.0235	-0.0009	0.0037	-0.0002	-0.3075	-0.352**
DSPFA	0.0553	-0.0335	-0.0181	-0.0156	-0.0078	-0.0224	0.0014	-0.0149	0.0035	0.0045	0.0006	0.0147	-0.0151	0.0000	0.0052	-0.0002	-0.2621	-0.304**
NNFSFA	0.0263	-0.0138	-0.0438	0.0151	-0.0071	-0.0094	0.0042	-0.0009	0.0140	0.0065	0.0034	0.0139	-0.0325	-0.0010	-0.0131	-0.0002	-0.5330	-0.572**
NNFPFA	-0.0133	0.0098	-0.0124	0.0535	0.0010	-0.0037	0.0017	0.0062	0.0005	-0.0037	0.0011	0.0043	-0.0031	-0.0015	-0.0097	0.0003	-0.1809	-0.1500
VL	-0.0295	0.0164	0.0196	0.0034	0.0159	0.0215	-0.0049	0.0032	-0.0123	-0.0056	-0.0022	-0.0137	0.0237	0.0004	0.0056	0.0005	0.4391	0.481**
PBP	-0.0308	0.0160	0.0088	-0.0042	0.0073	0.0470	0.0016	0.0056	-0.0098	-0.0067	-0.0005	-0.0116	0.0112	0.0016	-0.0023	0.0005	0.1932	0.227*
IL	0.0060	-0.0025	-0.0098	0.0049	-0.0042	0.0040	0.0187	-0.0003	0.0071	-0.0012	0.0016	0.0039	-0.0158	0.0008	-0.0059	-0.0002	-0.2231	-0.2160
DFFH	0.0394	-0.0206	-0.0016	-0.0136	-0.0021	-0.0109	0.0002	-0.0243	-0.0018	-0.0001	0.0004	0.0061	-0.0148	-0.0006	0.0053	0.0003	-0.1378	-0.1760
FL	-0.0122	0.0036	0.0191	-0.0009	0.0061	0.0143	-0.0042	-0.0014	-0.0321	-0.0070	-0.0047	-0.0062	0.0465	0.0016	0.0196	0.0005	0.5475	0.590**
FD	-0.0108	0.0059	0.0110	0.0076	0.0034	0.0121	0.0009	-0.0001	-0.0087	-0.0259	-0.0010	-0.0134	0.0082	0.0011	0.0212	-0.0001	0.3257	0.337**
AFW	-0.0093	0.0026	0.0185	-0.0071	0.0045	0.0029	-0.0037	0.0012	-0.0188	-0.0032	-0.0080	-0.0033	0.0702	0.0013	0.0185	-0.0002	0.7766	0.843**
NFP	-0.0200	0.0139	0.0171	-0.0065	0.0062	0.0154	-0.0021	0.0042	-0.0056	-0.0098	-0.0008	-0.0356	0.0088	0.0001	0.0156	0.0003	0.4704	0.472**
NSF	-0.0176	0.0063	0.0177	-0.0020	0.0047	0.0065	-0.0037	0.0045	-0.0185	-0.0026	-0.0070	-0.0039	0.0806	0.0012	0.0105	0.0002	0.7051	0.782**
TSS	-0.0112	0.0001	0.0090	-0.0164	0.0013	0.0155	0.0030	0.0028	-0.0101	-0.0056	-0.0020	-0.0005	0.0197	0.0049	0.0117	-0.0002	0.2486	0.271*
DM	0.0045	-0.0036	0.0118	-0.0107	0.0018	-0.0022	-0.0023	-0.0026	-0.0129	-0.0113	-0.0030	-0.0114	0.0175	0.0012	0.0487	-0.0001	0.4140	0.439**
AA	0.0066	-0.0027	-0.0034	-0.0071	-0.0037	-0.0104	0.0022	0.0033	0.0083	-0.0014	-0.0006	0.0053	-0.0078	0.0006	0.0030	-0.0021	0.0383	0.0280
FYP (kg)	-0.0198	0.0094	0.0250	-0.0104	0.0075	0.0097	-0.0045	0.0036	-0.0188	-0.0090	-0.0066	-0.0179	0.0608	0.0013	0.0216	-0.0001	0.9346	0.986**

Resi-0.0192 *, ** significant at 5% and 1% level, respectively

DSFA: Day to staminate flower anthesis, DSPFA: Days to first pistillate flower anthesis, NNFSFA: Node number to first staminate flower appearance, NNFPFA: Node number to first pistillate flower appearance, VL: Vine length(m), PBP: Primary branches per plant, IL: Internodal length (cm), DFFH: Days to first fruit harvest, FL: Fruit length (cm), FD: Fruit diameter (cm), AFW: Average fruit weight (g), NFP: Number of fruit per plant, NSF: Number of seed/fruit, TSS: T.S.S (°Brix), DM: Dry matter (%), AA: Ascorbic acid (mg/100g), FYP (kg): Fruit yield per plant(Kg), FYH (Q): Fruit yield (q/ha).

Path analysis

Genotypic and phenotypic path coefficient analysis conducted over Summer and kharif revealed that fruit yield per hectare (FYH) in cucumber is predominantly influenced by fruit size, reproductive efficiency, and flowering traits. At both genotypic and phenotypic levels, average fruit weight (AFW) emerged as the most critical trait, exhibiting strong direct effects (genotypic: Summer + 0.2119, *Kharif* + 0.7641, pooled + 0.7641; phenotypic: pooled-0.0080) and highly significant positive correlations with yield (r = + 0.7766 to + 0.915, $p<0.01$), largely through indirect contributions via fruit length (FL) and fruit diameter (FD)**.** FL showed high direct genotypic effect in Summer (+ 0.3957) and strong indirect effects via AFW (phenotypic pooled: + 0.0465), contributing to its strong correlation with yield (r = + 0.5475 to + 0.920, $p<0.01$). Similarly, FD displayed notable direct effects (phenotypic Summer + 0.1717, genotypic *Kharif* + 0.9308) and substantial indirect effects through AFW (phenotypic: + 0.0082; genotypic: + 0.3239), further confirming its yield-enhancing role (r = + 0.3257 to + 0.486, $p<0.01$). Number of seeds per fruit (NSF) was another key trait, contributing both directly (genotypic pooled + 0.0806; phenotypic pooled + 0.0806) and indirectly (via AFW and FD) to yield, with strong correlations observed (r = + 0.7051 to + 0.853, $p<0.01$). On the contrary, traits like days to first staminate flower appearance (DSFA) and days to first pistillate flower appearance (DSPFA) showed negative direct and indirect effects at both levels (e.g., phenotypic pooled DSFA direct: + 0.0602 but indirect:-0.0308 to-0.0235; genotypic pooled DSFA direct: + 0.8483, indirect:-0.3710 to-0.5374), leading to significant negative correlations with yield (DSFA:-0.3075 to-0.382; DSPFA:-0.2621 to-0.321, $p<0.01$). Node number of first staminate flower appearance (NNFSFA) also consistently reduced yield with strong negative direct effects (phenotypic:-0.0438; genotypic:-0.7068) and highly negative correlation (r =-0.5330 to-0.637, $p<0.01$). While internode length (IL) had a positive genotypic direct effect in Summer (+ 0.4284), it turned negative in pooled phenotypic and genotypic analyses (-0.4572) due to indirect effects through AFW. Notably, vine length (VL) and primary branches per plant (PBP) had positive indirect effects via fruit size traits, contributing positively to yield despite their varying direct impacts (VL phenotypic pooled direct: + 0.0159; genotypic direct:-0.1613; total r = + 0.4391 to + 0.554). Number of fruits per plant (NFP) had inconsistent direct effects (genotypic pooled:-0.6801; phenotypic pooled:-0.0356), but consistently significant positive correlations with yield (r = + 0.4704 to + 0.506, $p<0.01$) due to their strong indirect effects through FD and AFW. Similar findings are also reported by Rajawat *et al.*, (2018) in cucumber and Kumari *et al.*, (2018) in cucumber Overall, traits associated with fruit size (AFW, FL, FD) and seed number (NSF) were most influential in improving yield, while delayed flowering traits such as DSFA, DSPFA, NNFSFA had strong yield-reducing effects through both direct and indirect pathways.

Conclusion

The fruit yield (q/ha) had significant genotypic and phenotypic positive correlation with average fruit weight, number of seed per fruit, number of fruits per plant, fruit length, fruit diameter, and number of primary branches per plant in both season whereas average fruit weight had maximum positive direct and indirect effect on yield per plant. According to this result the genotypes which are all having maximum fruit length, average fruit weight, number of seeds per fruit, and fruit yield per plant are critical traits contributing directly and indirectly to higher yield. Therefore, these characters should be given priority in cucumber breeding programs aimed at yield enhancement.

Reference

1. Ahirwar CS, Singh DK. Assessment of genetic variability in cucumber (*Cucumis sativus* L.). International Journal of Current Microbiology and Applied Sciences. 2018;7(3):813-822.
2. Ahirwar CS, Singh DK, Kushwaha ML. Assessment of genetic variation in cucumber (*Cucumis sativus* L.) germplasm on correlation, path analysis and cluster analysis. Chemical Science Review and Letters. 2017;6(23):1886-1893.
3. Kaur M, Sharma P. Recent advances in cucumber (*Cucumis sativus* L.). The Journal of Horticultural Science and Biotechnology. 2022;97(1):3-23.
4. Kumar PJ, Syed S, Reddy PSS, Lakshmi LM, Reddy DS. Studies on correlation and path-coefficient analysis for yield and its contributing characters in cucumber (*Cucumis sativus* L.). International Journal of Chemical Studies. 2018;6(6):1649-1653.
5. Kumari A, Singh AK, Moharana DP, Kumar A, Kumar N. Character relationship and path coefficient analysis for yield and yield components in diverse genotypes of cucumber (*Cucumis sativus* L.). The Pharma Innovation. 2018;7(5, Part A):33.
6. Monge Pérez JE, Chacón Padilla K, Loría Coto M. Selection criteria for yield in cucumber (*Cucumis sativus*) grown under greenhouse conditions during the dry season. [Journal name not provided-please update].
7. Murtadha MA, Sanni TA. Interaction effects of seasons and farming practices on correlation and path analysis of yield of cucumber (*Cucumis sativus* L.). Journal of Ecobiotechnology. 2018;10:21-24.
8. Pal S. Genetic studies for yield and quality traits in cucumber (*Cucumis sativus* L.) [dissertation]. Solan (HP): Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni; 2016.
9. Rajawat KS, Shaktawat SK, Jat SL, Tak JK. Path analysis and characters association of cucumber (*Cucumis sativus* L.). International Journal of Chemical Studies. 2018;6(4):2414-2419.
10. Sharma S. Genetic divergence studies in cucumber (*Cucumis sativus* L.) [dissertation]. Solan (HP): Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni; 2017.
11. Sharma S, Kumar R, Chatterjee S, Sharma HR. Correlation and path analysis studies for yield and its attributes in cucumber (*Cucumis sativus* L.). International Journal of Chemical Studies. 2018;6(2):2045-2048.
12. Singh SS, Yadav GC, Kathayat K. Study of genetic variability in cucumber. Journal of Hill Agriculture. 2018;9:39-43.
13. Singh Y, Safiullah, Verma A, Sharma S, Sekhon BS. Genetic evaluation of cucumber (*Cucumis sativus* L.) genotypes for yield and its contributing traits under mid hill conditions of Himachal Pradesh, India. Environment and Ecology. 2017;35:3621-3626.