

Table 3 Effect of different concentrations of GA₃ and NAA on yield parameters of cabbage at THDC, Marpha, Mustang, 2024

Treatments	Number of inflorescences	Number of pods per inflorescence	Number of seeds per pod	TGW (g)	Yield (t/ha)
T ₁	104.67 ^e	12.00 ^d	21.67 ^c	1.17 ^e	1.48 ^e
T ₂	131 ^b	22.19 ^a	24.67 ^a	1.27 ^a	2.91 ^a
T ₃	134.67 ^{ab}	14.37 ^c	23.33 ^{abc}	1.21 ^c	2.21 ^c
T ₄	140 ^a	17.10 ^b	24.00 ^{ab}	1.28 ^a	2.68 ^{ab}
T ₅	118 ^d	15.55 ^{bc}	22.67 ^{bc}	1.17 ^e	1.65 ^{de}
T ₆	125 ^c	14.05 ^{cd}	22.33 ^{bc}	1.19 ^d	1.82 ^d
T ₇	136 ^{ab}	16.67 ^b	22.33 ^{bc}	1.24 ^b	2.53 ^b
LSD (0.05)	5.73	2.11	1.60	0.01	0.22
SEm(±)	1.86	0.68	0.51	0.005	0.07
F-probability	***	***	*	***	***
CV (%)	2.53	7.43	3.91	0.81	5.83
Grand Mean	127.04	15.99	23	1.21	2.18

Note: Means with the same letter within a column do not differ significantly at $p=0.05$ by DMRT. *= Significant at 5% ($p\leq 0.05$), **= Significant at 1% ($p\leq 0.01$), ***= Significant at 0.1% ($p\leq 0.001$), ns= non-significant, SEm= Standard error of the mean, LSD= Least Significant Difference, CV= Coefficient of variance, DAT= Days after treatment

4 Discussion

The growth and yield parameters of cabbage were significantly affected by the application of different concentrations of GA₃ and NAA. Notably, GA₃ at 50 ppm produced the highest seed yield (2.91 t/ha) and also resulted in superior performance across several traits, including peduncle height, number of leaves, pods per inflorescence and seeds per pod. Similar findings were reported by Roy and Nasiruddin (2011) who observed maximum cabbage yield at 50 ppm, suggesting that moderate concentrations of gibberellin are more effective than higher doses for optimizing plant productivity. Likewise, Kumar et al. (2023) reported the highest leaf number in plants treated with GA₃ at 50 ppm and the lowest in the control treatment which is in agreement with the findings of the present study. The enhanced leaf production observed under GA₃ application may be attributed to its stimulatory effect on the apical meristem, promoting cell division, cell elongation and nucleo-protein synthesis thereby increasing leaf initiation and development.

Furthermore, GA₃ at 50 ppm significantly increased the number of inflorescences, pods per inflorescence and seeds per pod, aligning with the findings of Dev et al. (2020). This suggests that a lower concentration of GA₃ enhances growth and seed yield more effectively than higher doses, which is consistent with the observation by Moniruzzaman et al. (2019) and Prodhan et al. (2022) that excessive GA₃ can induce disproportionate vegetative growth or physiological stress, ultimately reducing reproductive output.

NAA treatments also improved growth and yield parameters compared with the control, particularly at 100 ppm, which produced seed yield statistically comparable to GA₃ at 100 ppm. Auxins such as NAA are known to enhance cell enlargement, nutrient translocation and sink strength thereby supporting reproductive growth and seed formation. However, the overall response of cabbage to NAA was lower than that observed for GA₃ indicating that gibberellin played a more dominant role in regulating flowering and seed yield under the environmental conditions of Mustang. Similar positive effects of NAA on cabbage growth and yield have been reported by Neelam et al. (2023).

From a practical perspective, the findings indicate that foliar application of GA₃ at 50 ppm during head initiation and flowering can be recommended as an effective strategy for improving cabbage seed production in temperate regions of Nepal. Nevertheless, the study was conducted at a single location during one growing season. Therefore, further multi-location and multi-year studies are necessary to validate these findings under varying environmental conditions. Further investigations should also examine physiological and biochemical responses